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# WATERSHED WORK PLAN

## FAIRFOREST CREEK WATERSHED

### SPARTANBURG AND UNION COUNTIES

### SOUTH CAROLINA



U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
AND  
THE FOREST SERVICE

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FAIRFOREST CREEK WATERSHED  
SPARTANBURG AND UNION COUNTIES, SOUTH CAROLINA

The purpose of this addendum is to include in the Fairforest Creek Watershed Work Plan certain requirements of the Principles and Standards which are: Part I - Benefit to Cost Comparisons; Part II - Abbreviated Four Account Displays; and Part III - Abbreviated Environmental Quality Plan.

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PART 1  
BENEFIT TO COST COMPARISONS

Project costs based on 1974 prices, project benefits based on current normalized prices, and benefit-cost ratio based on 6 1/8 percent interest rate are as follows:

1. Annual Costs	\$13,500
2. Annual Benefits	17,300
3. Benefit-Cost Ratio	1.3 to 1
4. Benefit-Cost Ratio, excluding local secondary benefits	1.1 to 1

PART II - SELECTED PLAN

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measures of effects</u>
Beneficial effects:	
Value of users of increased output of goods and services	
1. flood prevention	\$ 12,600
2. utilization of unemployed and underemployed labor resources	
project construction and operation and maintenance	\$ 1,900
Total beneficial effects	\$ 14,500
Adverse effects:	
Value of resources required for a plan	
one floodwater retarding structure	
project installation (structural measure)	\$ 11,600
project administration	\$ 1,300
operation and maintenance	\$ 300
Total adverse effects	\$ 13,200
Net beneficial effects	\$ 1,300

ENVIRONMENTAL QUALITY ACCOUNT

Components

Measures of effects

Beneficial and adverse effects:

A. Areas of natural beauty

1. Creates one lake with four miles of shoreline and 62 surface acres of water.
2. Project output will make available regional funds and resources that can be used to enhance the physical appearance of 350 farms.
3. Inundates 62 acres presently consisting of bottomland hardwood, pine, and mixed hardwoods (47 acres) and pastureland (15 acres).
4. Clearing of 23 acres of forest land for dams, spillways, and borrow areas.

B. Quality considerations of water, land, and air resources

1. Floodwater damages reduced on 391 acres by approximately 90 percent.
2. Sediment deposition into Fairforest Creek from the watershed will be reduced by 50 percent.
3. Sheet and rill erosion will be reduced by 45 percent. Erosion from critical areas will be reduced by 67 percent.
4. Average annual suspended sediment concentration will be reduced from 245 mg/l to an average of 120 mg/l.

C. Biological resources  
and selected ecosystems

1. Creates 62 acres of lake fishing.
2. Provides resting and roosting areas for waterfowl.
3. Inundates 1.8 miles of stream with a low population of small non-game fish.
4. Clearing of 57 acres of forest for the lake will reduce bottom-land wildlife habitat by less than one percent.

D. Irreversible or  
irretrievable commitments

1. Seventy acres of forest land and 15 acres of pastureland will be required for the construction of the dam, spillway, and sediment pool.
2. Inundates 1.8 miles of stream.
3. Costs of labor, material and energy required to install project.

REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measure of effects</u>	
	<u>State of</u> <u>South Carolina</u>	<u>Rest of</u> <u>Nation</u>
A. Income		
Beneficial effects:		
Value of increased output of goods and services to users residing in the region		
1. flood prevention	\$ 12,600	-
2. utilization of regional unemployed or underemployed labor resources project construction and operation and maintenance	\$ 1,900	-
3. secondary	\$ 2,700	-
Total beneficial effects	\$ 17,200	-
Adverse effects:		
Value of resources contributed from within the region to achieve the outputs		
one floodwater retarding structure		
project installation (structural measure)	\$ 2,950	\$ 8,650
project administration	\$ 100	\$ 1,200
operation and maintenance	\$ 300	-
Total adverse effects	\$ 3,350	\$ 9,850
Net beneficial effects	\$ 13,850	\$- 9,850



## B. Employment

### Beneficial effects:

Increase in number  
and type of jobs

1. employment in agriculture, service, and trade activities	14 permanent semi-skilled jobs	-
2. employment for project construction	5 semi-skilled jobs for one year	-
3. employment for project operation and maintenance	0.1 permanent semi-skilled job	-
Total beneficial effects	14.1 permanent semi-skilled jobs	-
	5 semi-skilled jobs for one year	

### Adverse effects:

Decrease in number  
and type of jobs

1. loss in agricultural employment of project take area	0.4 agricultural job	-
2. loss in forest industry employment of project take area	0.1 forest industry job	-
Total adverse effects	0.5 permanent semi-skilled jobs	-
Net beneficial effects	13.6 permanent semi-skilled jobs	-
	5 semi-skilled jobs for one year	-

C. Population Distribution

Beneficial effects:	-	-
Adverse effects:	-	-

D. Regional Economic Base  
and Stability

Beneficial effects:	Creates 13.6 permanent semi-skilled jobs and 5 short-term semi-skilled jobs in an area where 15 percent of the families have incomes less than the national poverty level	-
Adverse effects:	-	-

SOCIAL WELL-BEING ACCOUNT

Components

Measures of effects

Beneficial and adverse effects:

A. Real income distribution

1. Creates 13.6 low to medium income permanent jobs for area residents.
2. Creates regional income benefit distribution of \$17,200 by income class as follows:

<u>Income Class</u> (dollars)	<u>Percentage</u> <u>of Adjusted</u> <u>Gross Income</u> <u>in Class</u>	<u>Percentage</u> <u>Benefits</u> <u>in Class</u>
Less than 3,000	5	20
3,000-10,000	61	48
More than 10,000	34	32

3. Local costs to be borne by region total of \$3,350 with distribution by income class as follows:

<u>Income Class</u> (dollars)	<u>Percentage</u> <u>of Adjusted</u> <u>Gross Income</u> <u>in Class</u>	<u>Percentage</u> <u>Contribution</u> <u>in Class</u>
Less than 3,000	5	8
3,000-10,000	61	66
More than 10,000	34	26

B. Life, health, and safety

Provides flood protection to roads and bridges.

## ENVIRONMENTAL QUALITY PLAN

### FAIRFOREST CREEK WATERSHED SPARTANBURG AND UNION COUNTIES, SOUTH CAROLINA

The goals of this environmental quality plan for Fairforest Creek Watershed are to (1) preserve and enhance areas of natural beauty; (2) maintain and improve the quality of the water, land, and air resources; and (3) preserve and enhance the biological resources and ecosystems of the watershed so that man can live in an aesthetically and culturally pleasing environment.

The principal environmental problems in the watershed are soil erosion and resulting sediment deposition on flood plains, and flooding of crop and pastureland along Sugar Creek.

The watershed lies in a rural setting of gently rolling Piedmont terrain interspersed with cropland, pastureland, and forest land. Soil erosion was very severe during the first half of the century when cotton was the principal cash crop. Critically eroding areas and gullies give evidence to past abuse. Shortleaf and loblolly pines are the dominant forest species and are usually found mixed with hardwoods in the natural stands. Pastures are usually planted to fescue, but improved bermuda grass and native grasses are also found. Many acres of pastureland suffer from over-grazing and lack proper management.

Clearing of mixed pine and hardwood stands for solid replanting of pine creates habitat for quail during the first few years of growth; however, solid pine stands five years old or older provide poor habitat for open land wildlife species. Clearing of bottom land hardwoods reduces this type of habitat for deer and other wildlife. Erosion of roadbanks, gullies, and galled areas contributes heavy sediment loads to the channel and flood plain of Fairforest Creek. Sediment deposition destroys trees and other vegetation, clogs stream channels, and reduces fish habitat.

Component needs for solving problems relating to specific environmental conditions are listed below:

1. Areas of natural beauty

- a. reduce sheet, gully, and roadside erosion in the uplands
- b. reduce sediment

2. Quality of water, land, and air resources

- a. improve the quality of the streamflow of Fall Creek by reducing the sediment being delivered to the streams
- b. protect the land from deterioration by reducing erosion and sediment
- c. maintain and enhance soil productivity
- d. reduce flood damages to crops, pastures, forests, and fixed improvements

3. Biological resources and ecosystems

preserve and enhance the habitat conditions for species of fish and wildlife present in the watershed by providing more dependable food supplies, avoiding excessive destruction of habitat, reducing losses of habitat from flooding and sedimentation, creating additional cover for selected species of wildlife, and creating additional habitat for fish

The plan elements for environmental quality consist of land treatment and structural measures. Cropland treatment measures would consist of conservation treatment systems as follows: (1) terraces, grassed waterways, field borders, land leveling, stripcropping, contour farming, and conservation cropping systems; and (2) grassed waterways, field borders, land leveling, contour farming, conservation cropping systems, and no-till planting. In addition, areas scattered throughout the watershed would receive partial treatment. Critically eroding cropland would receive special treatment for the establishment of permanent grasses. Wildlife food plantings would be included in the field border plantings, and other areas where supply is low.

The major treatment system on pastureland would include land leveling, removal of undesirable plant species, planting improved grasses and legumes, cross fencing, ponds, and a complete fertilization and liming program.

Conservation practices on forest land include tree planting, thinning, harvest cutting, wildlife food plantings, timber stand improvement, and protection from grazing and wildfires. In addition, critically eroding areas in forests will receive special treatment to establish permanent vegetation and improve wildlife habitat.

Treatment of land in other uses would include erosion control practices such as mulching and planting grasses, planting trees, and planting wildlife food plants. Special treatment would be applied to roadbanks and dirt roads. Practices for the improvement of fish habitat would be applied.

Planned land treatment systems would include changed land use on



those areas being used beyond their capabilities. These areas would be primarily cropland areas where erosion is a problem. Treatment would be the establishment of grass, trees, or wildlife food and cover.

Landowners would be encouraged, by the local soil and water conservation districts, to apply and maintain land treatment measures with assistance from the Soil Conservation Service, Forest Service, and other agencies. Financial assistance, usually on a cost-share basis, is available through the Rural Environmental Conservation Program administered by the Agricultural Stabilization and Conservation Service.

One multiple purpose floodwater retarding structure located on main Fairforest Creek would be installed to store sediment and floodwater. The structural measure would be implemented by the Union Soil and Water Conservation District and the Fairforest Creek Watershed Conservation District. Cost sharing funds are available under Public Law 566, as amended.

The estimated installation costs of the elements of the environmental quality plan are as follows:

1. Application of land treatment measures - \$800,000
2. One multiple purpose structure - \$2,000,000
3. Recreational facilities - \$342,200

The total installation cost of the environmental quality plan is estimated to be \$3,142,200.

The environmental effects that would result from installation of the environmental quality plan are as follows:

1. Areas of natural beauty
  - a. enhance the appearance of farms in the watershed through application and maintenance of land treatment measures
  - b. improve the scenic quality of roadsides and galled areas by shaping and revegetation
  - c. improve aesthetic quality of the landscape by providing a 62 acre lake in a wooded and grassed setting

2. Quality of water, land, and air resources

- a. reduce the sediment load carried by Fairforest Creek through the reduction of erosion and the storage of sediment in the structure
- b. reduce the deterioration of the land resource base by special treatment of critically eroding areas and improved conservation treatment
- c. reduce flooding on 391 acres of flood plain land along Sugar Creek below the structure to the degree that this land could be used for crops and improved pastures
- d. reduce maintenance to roads and bridges along Fairforest Creek and its tributaries

3. Biological resources

- a. change 62 acres of forest and pasture habitat to lake fishery
- b. improve wildlife habitat on upland through installation of land treatment measures

4. Irreversible or irretrievable commitments require a loss of 70 acres of forest and 15 acres of pasture for the pool, dam, and spillway. Inundate 1.8 miles of stream. The labor, material, and energy required to install the project is an irretrievable commitment of resources.



WATERSHED WORK PLAN AGREEMENT

between the

Spartanburg Soil and Water Conservation District  
Union Soil and Water Conservation District  
Fairforest Creek Watershed Conservation District

(hereinafter referred to as the Sponsoring Local Organizations)  
State of South Carolina

and the

Soil Conservation Service  
United States Department of Agriculture  
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Fairforest Creek Watershed, State of South Carolina, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Fairforest Creek Watershed, State of South Carolina, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Fairforest Creek Watershed Conservation District will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated cost \$50,500.)
2. The Fairforest Creek Watershed Conservation District assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894), effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Fairforest Creek Watershed Conservation District and the Service as follows:

	Fairforest Creek Watershed <u>Conservation District</u> (percent)	<u>Service</u> (percent)	Estimated Relocation <u>Payment Costs</u> (dollars)
Relocation Payments	62.2	37.8	0. <u>1</u> /

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Fairforest Creek Watershed Conservation District will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations (percent)</u>	<u>Service (percent)</u>	<u>Estimated Construction Cost (dollars)</u>
Floodwater Retarding Structure 5	0	100	125,800

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organizations (percent)</u>	<u>Service (percent)</u>	<u>Estimated Engineering Costs (dollars)</u>
Floodwater Retarding Structure 5	0	100	21,100

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$500 and \$22,300 respectively.
7. The Spartanburg and Union Soil and Water Conservation Districts will obtain agreements from owners of not less than 50 percent of the land above the reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Spartanburg and Union Soil and Water Conservation Districts will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan. Adequate treatment measures must be applied on at least 75 percent of the critical sediment sources above Floodwater Retarding Structure 5. The treatment of the critical

areas will be accomplished by a division of work as follows:

- a. On about 244 acres of gullies, the Service will construct diversions, install grade control structures to control gully growth, provide and apply seed, plants, fertilizer, lime, and mulch including one follow-up supplemental treatment. The districts will prepare seedbeds, remove terraces, slope banks as needed, and construct fences.
  - b. On about 281 acres of roadbanks, the Service will prepare seedbeds, provide and apply seed, plants, fertilizer, lime, and mulch including one follow-up supplemental treatment. The districts will slope roadbanks, and construct fences.
  - c. On about 600 acres where stabilization will be by tree planting the South Carolina Commission of Forestry, in cooperation with the U.S. Forest Service, will prepare sites, which may include applying seed, fertilizer and lime prior to planting trees. Where needed, a follow-up application of fertilizer will be made. The districts will provide seedlings, mulch, and construct fences.
  - d. On the remaining 905 acres of critical areas, the Service will remove terraces, construct diversions, provide and apply seed, plants, fertilizer, lime, and mulch including one follow-up supplemental treatment. The districts will prepare seedbeds, and construct fences.
  - e. The U. S. Forest Service will stabilize approximately 12 acres of gullies and 34 acres of other critically eroding land within the Sumter National Forest portion of the watershed through brush dam construction and tree planting.
9. Land treatment measures will be maintained by the owners and operators of the land on which they are installed, in cooperation with the Spartanburg and Union Soil and Water Conservation Districts.
  10. The Fairforest Creek Watershed Conservation District will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.



11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organizations have failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organizations in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organizations or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.
14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.
16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

FAIRFOREST CREEK WATERSHED  
CONSERVATION DISTRICT  
Local Organization

Box 97, Union, S. C. 29379  
Address Zip Code

By Joe W. Hyatt  
Title Chairman  
Date 9/10/75

The signing of this agreement was authorized by a resolution of the governing body of the Fairforest Creek Watershed Conservation District  
Local Organization

adopted at a meeting held on Wednesday, September 10, 1975

R. W. Williams  
Secretary, Local Organization

Route 1, Pauline, S. C. 29374  
Address Zip Code

Date 9/10/75

SPARTANBURG SOIL AND WATER  
CONSERVATION DISTRICT  
Local Organization

Room 306, Federal Building  
Spartanburg, S. C. 29301  
Address Zip Code

By P. E. Christopher  
Title Chairman  
Date 9/10/75

The signing of this agreement was authorized by a resolution of the governing body of the Spartanburg Soil and Water Conservation District  
Local Organization

adopted at a meeting held on August 29, 1968

Ansie E. Cooley  
Secretary, Local Organization

Rt 1, Chisnee, S.C. 29322  
Address Zip Code

Date 9/10/75

UNION SOIL AND WATER  
CONSERVATION DISTRICT

Local Organization

Box 97

Union, S. C. 29379

Address Zip Code

By

Title Chairman

Date September 10, 1975

The signing of this agreement was authorized by a resolution of the governing body of the Union Soil and Water Conservation District  
Local Organization

adopted at a meeting held on June 13, 1967

Dan C. Spence  
Secretary, Local Organization

Route 2

Jonesville, S. C.

Address

29353

Zip Code

Date September 10, 1975

Appropriate and careful consideration has been given to the environmental assessment prepared for this project and to the environmental aspects thereof.

SOIL CONSERVATION SERVICE  
UNITED STATES DEPARTMENT OF AGRICULTURE

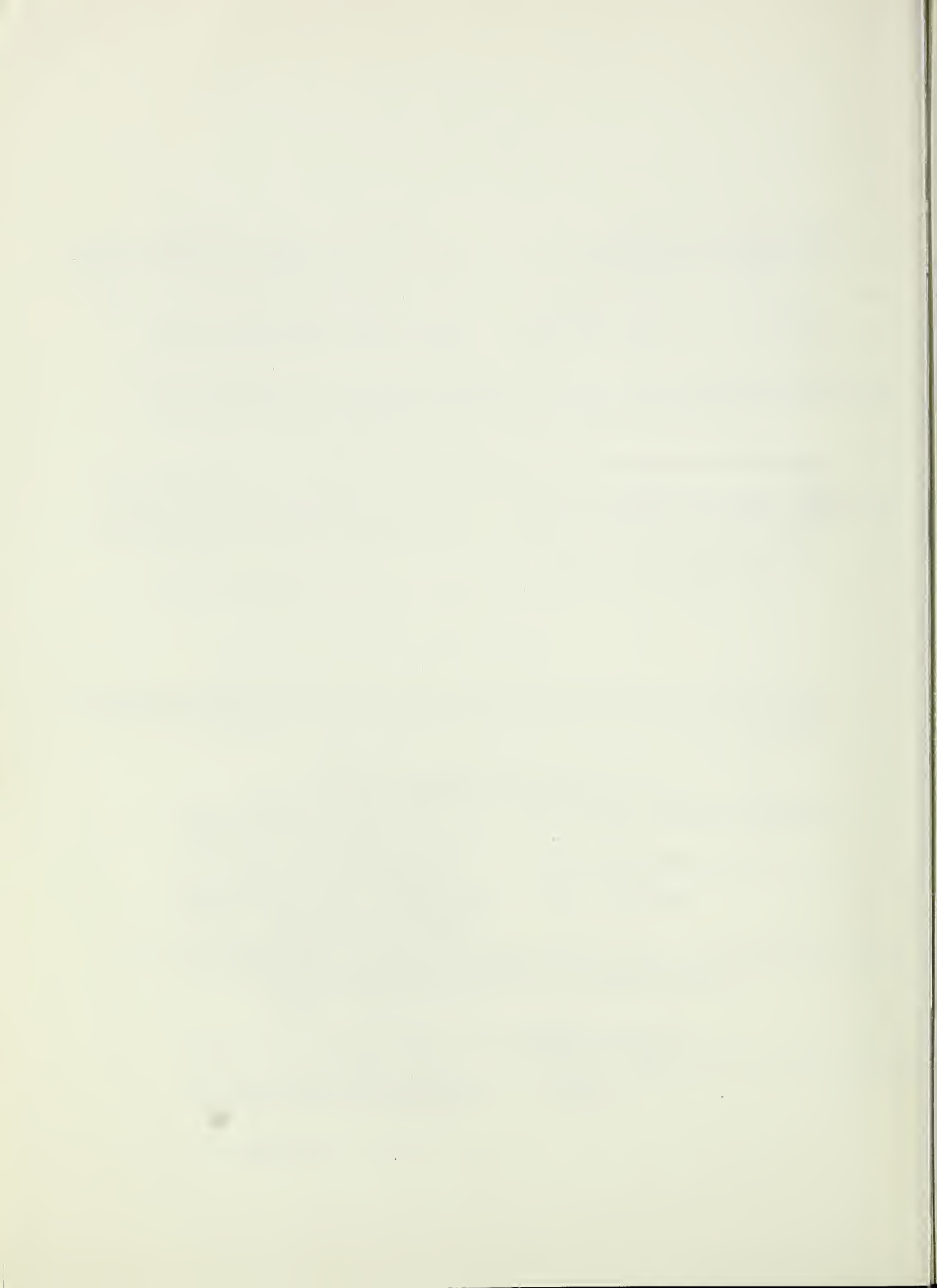
Approved by

G. E. Huey  
G. E. Huey, State Conservationist

9-15-75

Date





WATERSHED WORK PLAN

FAIRFOREST CREEK WATERSHED

Spartanburg and Union Counties  
South Carolina

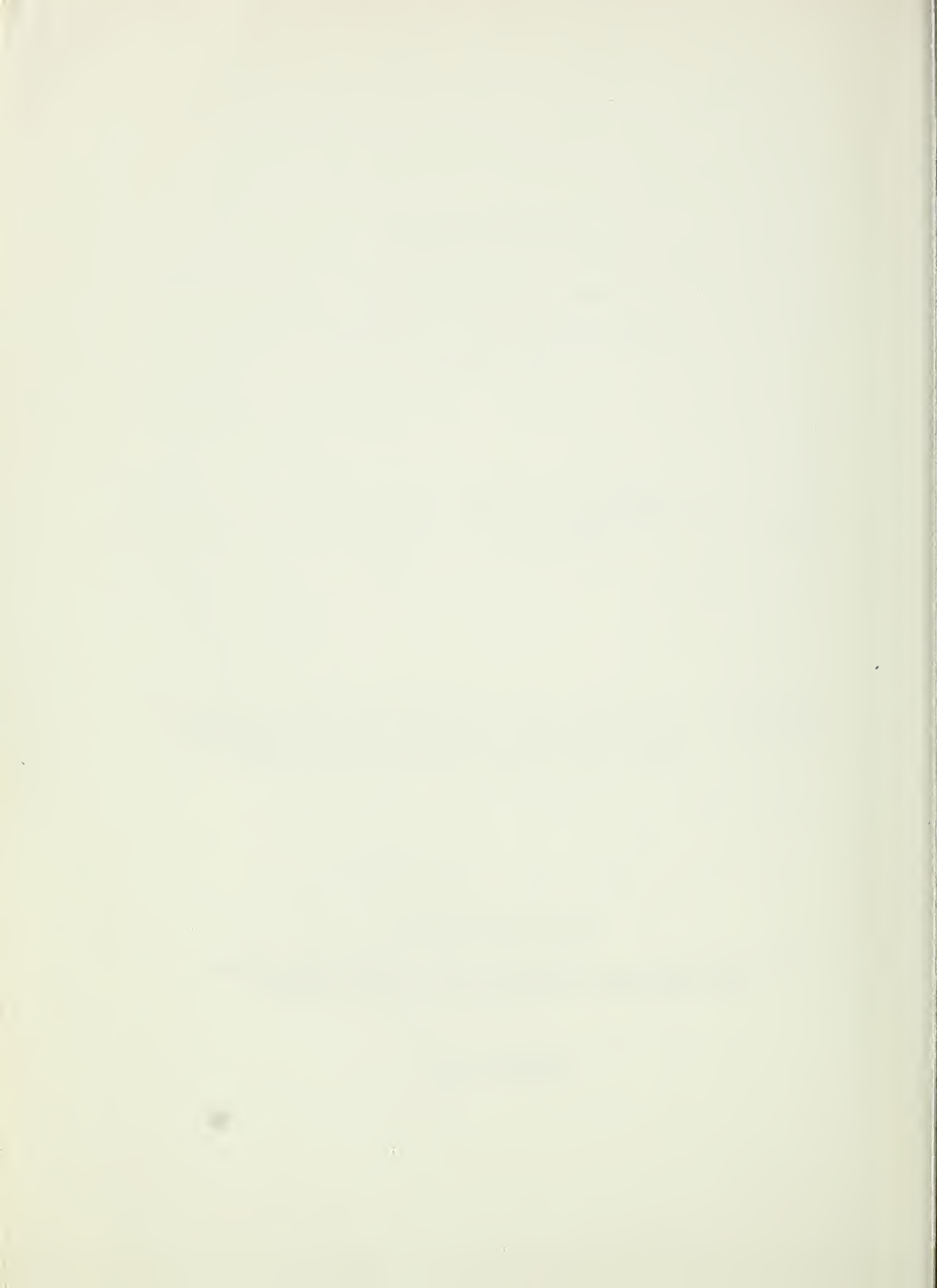
Prepared under the Authority of the  
Watershed Protection and Flood Prevention  
Act (Public Law 566, 83d Congress,  
68 Stat. 666), as amended.

Prepared by: Fairforest Creek Watershed Conservation District  
Spartanburg Soil and Water Conservation District  
Union Soil and Water Conservation District

With Assistance by:

U.S. Department of Agriculture, Soil Conservation Service  
U.S. Department of Agriculture, Forest Service

FEBRUARY 1975



## T A B L E O F C O N T E N T S

	<u>Page</u>
SUMMARY OF PLAN	1
WATERSHED RESOURCES - ENVIRONMENTAL SETTING	2
Physical Data	2
Economic Data	8
Fish and Wildlife	9
Recreation	10
Archeological and Historical Values and Unique Scenic Areas	11
Soil, Water, and Plant Management Status	11
WATER AND RELATED LAND RESOURCE PROBLEMS	13
Land Treatment	13
Floodwater Damage	13
Erosion Damages	14
Sediment Damage	16
Municipal and Industrial Water	17
Recreation	17
Fish and Wildlife	17
Economic and Social	18
Water Quality Problems	18
PROJECTS OF OTHER AGENCIES	19
PROJECT FORMULATION	19
Objectives	20
Environmental Considerations	20
Alternatives	21
WORKS OF IMPROVEMENT TO BE INSTALLED	22
Land Treatment Measures	22
Structural Measures	24
EXPLANATION OF INSTALLATION COSTS	27
EFFECTS OF WORKS OF IMPROVEMENT	29
Flood Prevention, Erosion and Sediment	29
Fish and Wildlife	30
Archeological, Historic, and Scientific	32
Economic and Social	32
PROJECT BENEFITS	33
COMPARISON OF BENEFITS AND COSTS	33

PROJECT INSTALLATION	34
FINANCING PROJECT INSTALLATION	35
PROVISIONS FOR OPERATION AND MAINTENANCE	36

#### TABLES

Table 1	- Estimated Project Installation Cost
Table 1A	- Status of Watershed Works of Improvement
Table 2	- Estimated Structural Cost Distribution
Table 3	- Structural Data - Structures With Planned Storage Capacity
Table 4	- Annual Cost
Table 5	- Estimated Average Annual Flood Damage Reduction Benefits
Table 6	- Comparison of Benefits and Costs for Structural Measures

INVESTIGATIONS AND ANALYSES	45
Land Use and Treatment	45
Structures	45
Hydraulics and Hydrology	46
Geology	47
Economics	48
Archeological and Historical Investigations	49
Fish and Wildlife	49

#### APPENDICES

Appendix A	- Characteristics of Streams
Appendix B	- Quality Standards for Class "B" Waters
Appendix C	- Surface Water Quality
Appendix D	- Water Wells, Maximum Consumption from Wells and their Chemical Analyses
Appendix E	- South Carolina Drinking Water Standards

#### CRITICALLY ERODING AREAS MAP

#### PROJECT MAP

WATERSHED WORK PLAN  
FAIRFOREST CREEK WATERSHED  
Spartanburg and Union Counties  
South Carolina

February 1975

SUMMARY OF PLAN

Fairforest Creek Watershed is located in Spartanburg and Union Counties, South Carolina. It comprises an area of 155,600 acres, with 41 percent in Spartanburg County and 59 percent in Union County. It lies in the Southern Piedmont Land Resource Area.

Sponsors of the project are the Spartanburg Soil and Water Conservation District, the Union Soil and Water Conservation District, and the Fairforest Creek Watershed Conservation District.

Flooding of pastureland along Sugar Creek is a major problem. Increased runoff, accelerated erosion and sediment production on lands being converted to urban use is a major concern. The need to stabilize critically eroding areas throughout the watershed and improve the quality of the environment is of equal concern.

The work plan provides for the installation of land treatment measures, a floodwater retarding structure, and stabilization of 2,076 acres of critically eroding land, including 46 acres to be stabilized by the U.S. Forest Service on National Forest lands. These measures will be installed within a five year period. The total estimated installation cost is \$2,456,500, of which \$929,600 will be borne by Public Law 566 funds and \$1,526,900 from other funds.

Land treatment measures will provide for the protection of watershed lands and enhance the quality of the environment. These measures are estimated to cost \$2,236,300, of which \$760,400 will be borne by Public Law 566 funds and \$1,475,900 from other funds. Public Law 566 funds will be used for accelerated technical assistance of which \$323,400 will be provided through the Soil Conservation Service and \$61,700 through the Forest Service.

The floodwater retarding structure will be an earth fill dam 39 feet high and will have a sediment pool with a surface area of 62 acres. Land needed for the pool areas, dam, and spillway amounts to 307 acres. The dam, spillway, and disturbed areas will be vegetated as a part of construction.

The estimated installation cost for structural measures is \$220,200, of which \$169,200 will be borne from Public Law 566 funds and \$51,000 from other funds.

Annual benefits from structural measures used for project justification



are \$17,200 with annual costs of \$13,200. The overall benefit cost ratio for the project is 1.3 to 1.0. Included in the benefits above are flood prevention benefits of \$9,100, and secondary benefits of \$2,700.

The proposed project will provide an estimated 96 percent reduction of average annual floodwater damage.

The sponsors have requested the Soil Conservation Service to do the contracting. The Fairforest Creek Watershed Conservation District will be responsible for operating and maintaining the floodwater retarding structure at an estimated annual cost of \$300. The operation and maintenance of land treatment measures will be the responsibility of the Spartanburg and Union Soil and Water Conservation Districts and will be performed by the individual owners of properties on which measures are installed, with technical assistance provided through going conservation programs.

#### WATERSHED RESOURCES - ENVIRONMENTAL SETTING 1/

##### Physical Data

The Fairforest Creek Watershed encompasses 155,600 acres in the Upper Piedmont region of South Carolina. About 41 percent of this area is in Spartanburg County and 59 percent in Union County. The watershed extends 35 miles from Spartanburg to Fairforest Creek's junction with Tyger River near Union. Tyger River Watershed lies to the west, and Pacolet River Watershed is to the north and east. The Tyger and Pacolet Rivers outlet into the Broad River. The cities of Spartanburg and Union lie partially within the watershed and have populations of 47,000 and 10,900 respectively<sup>2/</sup>. The towns and communities of Pacolet, Fairforest, Arcadia, Roebuck, Delmar, Pauline, White Stone, Glenn Springs, West Springs, Jonesville, Buffalo, Monarch Mills, Bonham, Carmen and Santuck lie within the watershed. The population of the watershed is about 60,000. Approximately three-fourths of the population is urban, with the remaining one-fourth evenly divided between farm and rural non-farm.

1/ All information, except as otherwise noted by reference to source, were collected during watershed planning investigations by the Soil Conservation Service and Forest Service, U.S. Department of Agriculture.

2/ The National Atlas of the United States of America, U.S. Department of the Interior, Geological Survey, Washington, D.C., 1970.



The land is presently being used as follows:

<u>Land Use</u>	<u>Total Watershed</u>		<u>Flood Plain</u>	
	<u>Acres</u>	<u>Percent</u>	<u>Acres</u>	<u>Percent</u>
Cropland	1,400	0.9	370	4.0
Pastureland	15,600	10.0	1,580	17.0
Forest land	133,700	86.0	7,100	76.3
Idle land	2,800	1.8	50	0.5
Urban and built-up areas	2,100	1.3	200	2.2
TOTAL	155,600	100.0	9,300	100.0

Fairforest Creek drains into the Tyger River, a tributary to Broad River within the Santee River Basin. Its watershed is in the South Atlantic-Gulf Region and the Santee-Edisto subregion designated by the U.S. Water Resources Council<sup>1/</sup>. Some of the larger tributaries of Fairforest Creek are Kelsey, Kennedy, Spear, Mitchel, Rocky, Sugar, Buffalo, Tinker and Shoal Creeks. All of these streams are perennial from their middle to lower reaches with the upper reaches becoming intermittent during periods of low rainfall. Characteristics at selected locations along some of the perennial streams are shown in Appendix A.

Field and map surveys indicate that there are approximately 500 miles of perennial streams within the watershed. These streams are supported by nearly 800 miles of intermittent drains. A field survey of selected areas within the watershed indicates that a drainage area of 300 to 400 acres is needed to support an intermittent stream. The topography of the upper Piedmont is highly dissected. A large number of ephemeral drains usually supports the intermittent streams. Three to five miles of ephemeral drains usually support each intermittent stream at its origin.

There are approximately 400 small lakes and ponds within the watershed. About 600 acres of permanent water have been impounded. The largest lakes included are Lake Tom Moore Craig and Lake Edwin Johnson, both located in Croft State Park. Lake Craig has 150 acres of permanent water and Lake Johnson has 40 acres. Duncan Park Lake near Spartanburg and Zimmerman Pond near the community of Pauline are

<sup>1/</sup> Water Resources Regions and Subregions for the National Assessment of Water and Related Land Resources, July 1970, Water Resources Council, Washington, D.C.

slightly smaller.

The cities of Spartanburg and Union, along with several smaller communities receive their water from sources outside the Fairforest Creek drainage area. Spartanburg Water Works furnishes most of the water needed for residents in the upper part of the watershed, and the supply is obtained from reservoirs on the South Pacolet River. Jonesville obtains water from Miller Reservoir located on a tributary of the Pacolet River. Union obtains water from the Broad River.

Buffalo Mills and the town of Buffalo obtain water from Buffalo Creek, a tributary of Fairforest Creek. Mayfair Mills, located west of Spartanburg near the headwaters of Fairforest Creek, obtains water from Fairforest Creek.

Several of the older industries and most of the rural residents obtain water from wells. Ground water sources are generally adequate for rural residents. However, as the rural and urban population increases, the economic feasibility of obtaining water through a group distribution system from surface water sources increases.

Fairforest Creek and its tributaries have been classified by the South Carolina Department of Health and Environmental Control as Class "B" streams<sup>1/</sup>. (See Appendix B.) Streams in South Carolina are classified according to local peoples' desires and intended uses of the water. The classification assigned a stream does not necessarily indicate existing stream quality. Appendix C shows present raw surface water quality at selected points in the watershed.

Class "B" waters are defined as being suitable for municipal and industrial water with proper treatment and for uses requiring lesser quality. The South Carolina Department of Health and Environmental Control has the authority to enforce water quality standards.

The city of Spartanburg sewage treatment plant discharges effluent into Fairforest Creek. Gasoline storage plants and other industrial sites contribute to polluting the upper streams of the watershed. Small amounts of fertilizer enter into the streams from farm and urban use.

The watershed has a highly developed road system. Interstate Highways 26 and 85 intersect at the northern end of the area and U.S. Highways 221 and 176 traverse parts of the watershed. There are numerous state and county roads in the area. The watershed is serviced by three railways, and a commercial airport is located near Spartanburg.

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<sup>1/</sup> Stream Classifications for the State of South Carolina, South Carolina Department of Health and Environmental Control, 1972.



Climatic data for the watershed are:

Mean temperature, annual - 61 degrees Fahrenheit  
Average precipitation, annual - 49 inches  
Average length of growing season - 219 days  
Average date of last spring freeze - April 1  
Average date of first fall freeze - November 6

The average summer has 70 days of maximum temperatures of 90 degrees or more. An average winter has about 12 days of temperature falling below 20 degrees. The rainfall is reasonably well distributed seasonally<sup>1/</sup>.

The geologic structure within the area consists of belts of metamorphosed rock intruded by igneous rock. These belts are called Kings Mountain Belt and Inner Piedmont Belt. Major rock classes are biotite schist, hornblende gneiss, sericite schist, granitoid gneiss, and Yorkville monzonite. The general trend of the rock belts are northeast-southwest, assuming a parallel with the metamorphosing force area of the Appalachian Mountain Range. Geologic ages for the rock materials range from Upper Pre-Cambrian (oldest) to Permian (most recent).

Mineral resources of the watershed are virtually untapped. Several mines are located in Spartanburg County, but none of these are located within the watershed. Sand, gravel, crushed stone, vermiculite, and feldspar are some of the materials being mined in the county at present<sup>2/</sup>. Deposits of these minerals are probably present in Fairforest Creek Watershed. Mining operations are very limited in Union County.

Ground water resources are adequate for individual household use. Most of the available ground water is stored in weathered zones of the country rock. Fractures within the rock allow deep weathering to occur, providing the necessary void spaces where water may be trapped and stored. Most wells within the area produce an average of 20 gallons per minute. Many of these wells were dug with minimal equipment<sup>3/</sup>. Wells drilled to obtain maximum yield averaged 53 gallons per minute<sup>3/</sup>. Maximum consumption data from sample watershed wells, their chemical analyses, and state drinking water standards are shown in Appendices D and E.

1/ The Climate of South Carolina, Climatic Series No. 1, Department of Agronomy and Soils, South Carolina Agricultural Experiment Station, Clemson Agricultural College, July 1958.

2/ South Carolina Mineral Producers Directory, South Carolina State Development Board, Circular 2, 1972.

3/ Water Resources of Spartanburg County, South Carolina Water Resources Commission, Report No. 3, U.S. Geological Survey, 1970.

There are 700 tracts of land in the watershed. Many of these have conservation plans. Croft State Park in Spartanburg County contains about 7,088 acres. Sumter National Forest in Union County occupies about 4,950 acres within the watershed. Both of these areas make up about nine percent of the watershed and consist primarily of managed forest land.

The following table shows the principal soil series found in the watershed and the dominant characteristics of each<sup>1/2/</sup>:

<u>Soil Series</u>	<u>Slope Range</u> (percent)	<u>Permeability</u>	<u>Depth</u>
Appling	2-10	Moderate	Deep
Cartecay <sup>3/</sup>	0- 2	Moderate	Deep
Cataula <sup>4/</sup>	2-15	Slow	Deep
Cecil	2-15	Moderate	Deep
Congaree <sup>3/</sup>	0- 2	Moderate	Deep
Davidson	2-15	Moderate	Deep
Enon <sup>5/</sup>	2-15	Slow	Moderately Deep
Hiwassee	2-15	Moderate	Deep
Louisburg	6-40	Rapid	Shallow
Madison	2-40	Moderate	Deep
Pacolet	10-40	Moderate	Moderately Deep
Wilkes	6-40	Moderate-Slow	Shallow

<sup>1/</sup> Soil Survey of Spartanburg County, South Carolina, U.S. Department of Agriculture, Soil Conservation Service, 1968.

<sup>2/</sup> Soil Survey of Laurens and Union Counties, South Carolina, (now being printed), U.S. Department of Agriculture, Soil Conservation Service.

<sup>3/</sup> Flood plain soils. Cartecay is moderately well to somewhat poorly drained. All other soils are well drained.

<sup>4/</sup> Has fragipan.

<sup>5/</sup> Has high shrink-swell characteristic.

Classification of watershed soils by capability class and subclass is shown below:

<u>Capability Class and Subclass</u>	<u>Percentage of Watershed Area</u>	<u>Number of Acres</u>
IIe	17.3	27,040
IIIe	19.0	29,490
IVe	17.9	27,930
VIe	14.0	21,650
VIIe	22.6	35,270
IIw	1.4	2,230
IIIw	1.7	2,650
IVw	2.3	3,530
Vw	0.6	890
Miscellaneous <u>1/</u>	3.2	4,920

The land capability classification system is the grouping of soils to show, in a general way, their suitability for most kinds of field crops, pasture and wildlife. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The letter "e" indicates that erosion is the primary hazard and "w" designates a wetness hazard. Capability Classes II and III include those soils suitable for annual or periodic cultivation of row crops. Capability Class IV includes those soils on which cultivation should be undertaken only occasionally or under very careful management. Capability Classes VI and VII include those soils considered unsuitable for cultivation of row crops, but can be used for pasture, forest, or wildlife plantings.

The 9,300 acres of flood plain soils along Fairforest Creek and its tributaries are classified as IIw, IIIw, IVw and Vw land. The major problems on this land are floodwater and sediment damages that have caused the farmers to abandon most of the flood plain land. Generally, the flood plain nearest to developing areas of towns and cities receive more pressure for development. There are only a few improvements on the Fairforest Creek flood plain subject to serious floodwater damage and these are within or near Spartanburg. The only constructed improvements usually are the roads and bridges. The entire Fairforest Creek flood plain is shown on the attached project map.

The watershed is approximately 94 percent upland and six percent bottom land. The weathering process has sculptured a profile of gently sloping to moderately steep hills and narrow valleys within the area.

1/ Made land, mixed alluvial land, gullied land and water.



The hills north of Spartanburg approach an elevation of 910 feet. South of Union, Fairforest Creek enters into Tyger River at an elevation of 330 feet.

The principal upland tree species are loblolly pine, shortleaf pine, virginia pine, red cedar, red oak, white oak, and dogwood. The undergrowth consists of vine, honeysuckle, brier and native grasses near the fringe areas. Bottom land tree species are red maple, yellow poplar, ash, willow, sycamore, red gum, cottonwood, black gum, water oak and willow oak. In well shaded areas, the undergrowth is limited to seedlings and a few vines. Vegetation in open meadows includes native grasses, vines, briars, plum bushes and persimmon. Most of the plant communities are constantly being altered by landowners and others.

#### Economic Data

Croft State Park containing 7,088 acres and 4,950 acres of National Forest are within the watershed. Except for other small tracts of public land, the remainder of the watershed is in private ownership.

Overall, farming is practiced on a minor scale in the watershed. The types of farms range from the small part-time unit to the larger full-time family operation. Approximately 74 percent of the commercial farms in the watershed have total annual sales of less than \$10,000. The average size of the farm operation in the watershed is 300 acres. Of the approximately 700 tracts of land in the watershed, 80 percent is in parcels of less than 100 acres. The average value of upland is \$400 per acre in Spartanburg County and \$300 per acre in Union County. Bottom land is valued at an average of \$500 per acre in Spartanburg County and \$400 per acre in Union County.

The major farm enterprise of the watershed is beef cattle, and the principal cash crops grown are soybeans and corn. The average yields for the major crops are as follows:

<u>Crops or</u> <u>Grasses</u>	<u>Unit</u>	<u>Yield</u>	
		<u>Upland</u>	<u>Bottom land</u>
Pasture	Acre	3 AUM*	6 AUM*
Soybeans	Acre	20 bu.	35 bu.
Corn	Acre	40 bu.	80 bu.

The forest land acres are 94 percent well stocked, with 84 percent of this amount being in merchantable tree species. The sawtimber

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\* Animal Unit Month.

volume averages 1,487 board feet per acre of pine, and 416 board feet per acre of hardwood. The pulpwood averages 404 cubic feet per acre of pine, and 117 cubic feet per acre of hardwood.

Upland forest types are pine, 68 percent; pine-hardwood, 14 percent; hardwood-pine, 8 percent; and hardwood, 10 percent. The principal species of the upland are loblolly pine, shortleaf pine, Virginia pine, red cedar, red oak, white oak, yellow-poplar, sycamore, sweetgum, hickory, and dogwood.

Employment in the watershed is mostly in the nonagricultural sector. Only two percent of the work force is engaged in agriculture in Spartanburg County and five percent in Union County. Over 43 percent of those employed are engaged in manufacturing, with the majority being in textile mill products. The next largest employment sectors are wholesale and retail trade, services, and government.

Per capita income is about \$2,500 in Spartanburg County and \$2,200 in Union County. About 14 percent of the families in Spartanburg County and 15 percent in Union County have incomes below the poverty level.

Spartanburg County is covered under the Appalachian Regional Development Act of 1965. In 1971, Union County was declared to be an area of high unemployment and underemployment under the Economic Development Act of 1965. Union County is a part of the six county Crossroads of History Resource Conservation and Development Project which is in operations. The state is divided into ten planning regions. Spartanburg County is part of the South Carolina Appalachian Council of Governments, and Union County is part of the Catawba Regional Planning Council.

#### Fish and Wildlife

Generally, the channel of Fairforest Creek, except for the lower six miles, is filled with sand; and the wide, shallow flow is not conducive to a fishery resource. The Kelsey Creek tributary has had serious pollution problems caused by an industrial park and overflow of municipal sewage. Recent efforts in pollution control have greatly reduced pollution in Kelsey Creek, but the potential for an accidental spill or malfunction which will have damaging effects downstream still exists.

There are 400 ponds and lakes now in existence in the watershed, having about 600 acres of water surface. All of the ponds and lakes provide some fishing.

The good dispersion of dependable water sources over the watershed has a very favorable influence upon many species of wildlife. One example is that of mourning doves. These birds must have drinking water daily within easy flight range if they are to use an area for nesting. The fact that the ponds and lakes are dispersed make them much more valuable to waterfowl than if the same amount of water was in a single lake.

An appreciable portion of the flood plain of Fairforest Creek above the National Forest provides relatively poor wildlife habitat, even



though it is wooded. The extensive sediment deposits over the flood plain have created conditions unfavorable for tree species and size valuable to wildlife. Within the National Forests, the sediment deposits are not as extensive and there is a good variety of tree species conducive to wildlife habitat.

No species on the current list of endangered wildlife species are known to occur in the watershed. It is possible, on rare occasions, that a peregrine falcon could be a temporary winter visitor.

All kinds of birds and other wildlife common to Piedmont South Carolina exist in the watershed at appropriate seasons. The extensiveness of cropland, pastureland, forest land, brushland, and fallow land, along with the numerous small streams, makes a variety of habitats for birds as well as other kinds of wildlife.

A unique feature occurring about midway of Fairforest Creek is a 50 acre "duck marsh". This has been created over a period of years through a natural dam which developed in a wide segment of the flood plain through sediment deposits. The shallow water marsh is filled with overflow from the creek. During the fall and winter, it is attractive to waterfowl and is popular with local hunters.

Approximately 25 square miles in the lower reaches of Fairforest Creek are in the Fairforest Creek Game Management Area. Public hunting for deer, wild turkey, and small game is available. A unique hunting feature provided in the Fairforest Creek Game Management Area is a special open season for hunting with primitive weapons (flint lock, cap and ball, bow and arrow). Hunting on the game management area requires the purchase of a permit in addition to the regular hunting license.

There are 80 miles of pipeline and high voltage transmission lines in the watershed. The cleared and maintained rights-of-way of these lines result in extensive edge-type wildlife habitat. In some areas, the rights-of-way provide the only habitat for openland wildlife in what would otherwise be entirely wooded tracts.

### Recreation

Croft State Park, which contains 7,088 acres, is located in the watershed about five miles southeast of Spartanburg. Two lakes, with surface areas of 150 and 40 acres, are located in the park and provide fishing and boating opportunities. The quality of water in the lakes is not suited for swimming or other body contact sports. The park has camping areas, hiking and bike trails, playgrounds, and picnic facilities. Only a small portion of the park is developed for intensive use. In 1967-68, 13,000 visitors used the park.

Rose Hill State Park, essentially historical, is near the southern edge of the watershed. The mansion of William Gist, the state's "Secession Governor" is open to the public and located in this park.

Four thousand nine hundred and fifty acres of the Enoree Division of the Sumter National Forest are within the watershed. There are no

National Forest recreation areas within the watershed. However, Dogwoods Picnic Area is located just below the confluence of Fairforest Creek and Tyger River. Part of the Fairforest Creek Game Management Area in the Central Piedmont Hunt Unit is within the watershed and provides hunting opportunities for the public.

#### Archeological and Historical Values and Unique Scenic Areas

Historic places in the Spartanburg County portion of the watershed and their date of entry in the National Register of Historic Places are: Jammie Seay House (10/7/71), Foster's Tavern (12/18/70), and Camp Hill (7/16/70) and includes the following sites for the Union County portion: Rose Hill (6/5/70), Herndon Terrace (8/25/70), and Means House (4/13/73). An inventory of the historic values in the proposed project area was made by the South Carolina Department of Archives and History.

A field study of the proposed floodwater retarding structure and impoundment area by the Institute of Archeology and Anthropology, University of South Carolina revealed no significant archeological values.

#### Soil, Water, and Plant Management Status

Over the past 20-30 years, many changes have taken place in the watershed. Emphasis has shifted from row crop farming to livestock and tree farming. This change is reflected in the following data taken from publications of the South Carolina Crop Reporting Service:

##### Spartanburg County

	1944	1954	1964	1972
Cotton (ac.)	57,700	25,600	7,300	4,950
Corn (ac.)	56,000	28,700	5,150	3,400
Soybeans (ac.)	50	50	3,800	11,100
Beef Cows (no.)	-	-	9,400	12,400

##### Union County

	1944	1954	1964	1972
Cotton (ac.)	13,900	6,450	1,900	220
Corn (ac.)	16,500	6,900	1,300	500
Soybeans (ac.)	50	50	300	600
Beef Cows (no.)	-	-	4,200	5,300



Many factors seem to have contributed to the shift from row crop production. These include lack of available labor, the economics of mechanized farming on small acres, and land deterioration from sheet and gully erosion.

Land which is now cropped will continue to require contour cultivation, terraces and waterways. Much of the land no longer in row crops has been abandoned to briers, sumacs, plum bushes, and scattered pines. Although this land is partially protected from erosion, it is producing little economic benefit.

There are approximately 400 tracts of land in the Union County portion of the watershed, of which 247 owners have agreements with the Union Soil and Water Conservation District, and 214 have conservation plans. Approximately 300 tracts of land are in the Spartanburg County portion of the watershed, of which 76 owners have agreements with the Spartanburg Soil and Water Conservation District, and 66 have conservation plans. Of the conservation plans in effect, 80 percent of the planned practices in Union County and 65 percent of those in Spartanburg County have been applied.

The South Carolina State Commission of Forestry, in cooperation with the U.S. Forest Service, through the various federal-state cooperative forestry programs, is providing forest management assistance, forest pest control assistance, forest fire protection and suppression, and distributing planting stock to private landowners. Fire protection is provided by the U.S. Forest Service on National Forest lands and by the going state fire control program on state and private lands.

The Spartanburg and Union Soil and Water Conservation Districts, in cooperation with the Soil Conservation Service, presently provide technical assistance under authority of Public Law 46 to landowners. Both districts have sponsored other watershed projects in their respective counties.

Although Spartanburg County is in the Appalachian Region and Union County is in the Crossroads of History Resource Conservation and Development area, efforts from these two programs have been concentrated in areas not covered by watershed projects.

There is active interest in developing land use and subdivision regulations to avoid creating erosion, drainage, and flooding problems. Local committees, with assistance from state and federal agencies are preparing building codes, designating flood-prone areas, and considering needed restrictions on areas with limitations for certain uses. County-wide sediment control regulations for Spartanburg County have been adopted. Subdivision regulations have been prepared and are being reviewed which will apply to all of Spartanburg County. Except for the city of Spartanburg and vicinity and the extreme headwater areas, there has been little or no development within the flood plain that suffers from flooding.

The city of Spartanburg has adopted an ordinance to prohibit any building in the flood plain below the "Standard Project Flood" as outlined in the Flood Plain Information report for Lawsons Fork Creek



and Fairforest Creek prepared by Corps of Engineers, U.S. Army, Charleston, South Carolina District.

#### WATER AND RELATED LAND RESOURCE PROBLEMS

##### Land Treatment

Conversion of cropland to pasture and trees has decreased the rate of erosion in the watershed; however, the average soil loss rate is still higher than the considered maximum to sustain productivity. Gullies and critically eroding areas need special treatment to reduce sediment yields.

Much of the land in row crops is being used beyond its capabilities and should be converted to less intensive uses. On other cropland areas, a system of terraces and grassed waterways is needed in combination with no-till planting or grass based rotation. Proper management is necessary to keep soil loss within allowable limits on all the land in the watershed.

About 72,000 acres of the forest land are owned or leased by commercial forestry industries who carry out an intensified forest management program. Private landowners have 49,662 acres of forest land and generally need assistance in proper forest management practices. Timber and pulpwood are not being harvested on regular schedules. In many areas, scrub or weed trees are replacing more desirable species.

##### Floodwater Damage

There are 9,300 acres of land in the watershed which are subject to flooding. Floodwater usually inundates the flood plains soon after or during rains and recedes in a short period of time. Average annual flooding amounts to 15,000 acres. The land use of the flood plain is four percent cropland, 17 percent pastureland, and 79 percent forest land. Most of the cropland is in soybeans and corn. There are approximately 300 flood plain landowners who have holdings from only a couple of acres to as much as 360.

Sixty-seven percent of the floods occur during the period of January through April. However, the major flood damage to crops and pasture is caused by the floods which occur during the period of April through November. Forty-one percent of the floods occur during this period. Floodwater causes delays in preparing the soil for planting and damages and reduces the value of crops. Grazing time is lost as a result of flooding. Floodwater also causes damage to fences and farm equipment. Roads and bridges are often damaged or destroyed by the larger floods. The average annual damage suffered from flooding of cropland and pastureland at present amounts to \$49,800. A greater damage incurred by the landowners is the loss of productivity from foregone restoration. With the existing flood

hazard, the flood plain lands cannot be utilized compatible with their agricultural potential. The total average annual floodwater damage on Sugar Creek amounts to \$8,080 a year. (See Table 5.) Of this amount, \$4,400 of damage occurs on 98 acres of cropland, and \$3,600 of damage occurs on 156 acres of pastureland. This damage directly effects 22 landowners on Sugar Creek.

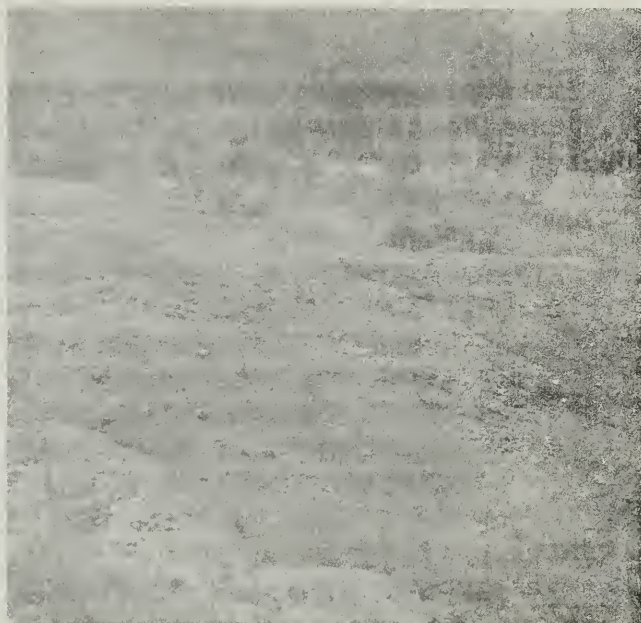
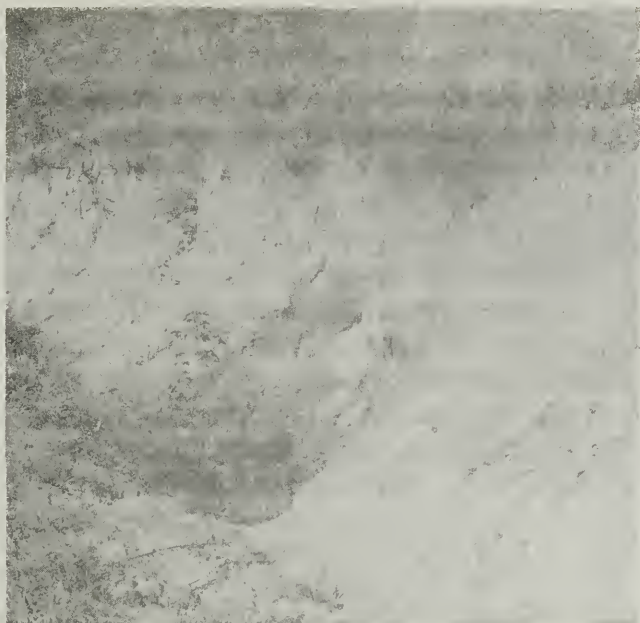
#### Erosion Damages

Land use has changed from cultivation to grassland and forest land in the last 30 years as described under "Environmental Setting". Approximately 570 acres of unstable land are associated with gullies throughout the watershed, and about 12 acres are being voided annually. Erosion from increased residential and industrial development has become a major problem in the developing areas. Construction activities, borrow pit operations, and land fill measures are creating areas of erosion throughout the watershed. At present, there are 2,076 acres of critically eroding land needing stabilization. These areas are nearly uniformly distributed over the drainage area of Fairforest Creek. Most areas are less than 10 acres in size. Approximately 25 percent of the 460,000 tons of soil eroding annually occurs on these areas. About 275 critical areas have been located. (See Critically Eroding Areas Map.) It is estimated there are more than 300 sites in need of treatment to control critical erosion. The following shows the types of critical areas by county:

	Union County	Spartanburg County	Total
	(acres)		
Gullies	389	181	570
Roadsides	81	200	281
Galled Areas	190	451	641
Disposal and Borrow Areas (Abandoned)	147	87	234
All Other	200	150	350
TOTAL	1,007	1,069	2,076

Cultivated cropland has decreased nearly 85 percent since 1940 for Spartanburg and Union Counties. Many acres were simply abandoned. Terraces and waterways concentrate runoff in areas unprotected by vegetation creating favorable conditions for gully development. Roadside erosion is severe because the road ditches and banks have not been sloped, shaped, seeded, or vegetated. Most of the roads were constructed prior to present construction techniques and stabilization





requirements. Income from part-time, marginal farming has not been sufficient to encourage the user to invest in conservation measures to correct the many galled areas that are eroding and becoming larger. A number of borrow areas and disposal dumps have been abandoned without being vegetated.

#### Sediment Damage

Intensive cultivation of the uplands in past years produced large sediment yields and resultant damages to the flood plain land. As land use has changed from row crops to pasture and forest, sediment delivered to the channels and flood plains has decreased. This reduction of sediment has allowed the tributary channels to restore their natural capacity and flood damages along the tributaries, except Sugar Creek, have become minor.

Sediment from the tributaries has been deposited in the Fairforest Creek channel and flood plain creating swamp areas. The present estimated average annual sediment concentration in Fairforest Creek at State Secondary Highway 49 is 245 milligrams per liter. Average annual suspended sediment concentrations at other locations are:

Sugar Creek at State Highway 25	- 740 mg/l
Black Branch at Fairforest Creek	- 570 mg/l
McElwain Creek at Fairforest Creek	- 490 mg/l
Fairforest Creek at State Highway 12	- 400 mg/l

Fairforest Creek channel from State Secondary Highway 12 to State Highway 215 is filled with sand. The rock shoal just below State Secondary Highway 49 serves as a grade control structure and prevents the sand from moving downstream. Earth fill at highway crossings and a natural restriction in the channel near the confluence with Spear Creek adds to this problem. Loss of channel capacity has resulted in increased flooding and swamping along Fairforest Creek. This condition is expected to become worse if the critical areas upstream are not stabilized. There are approximately 2,000 acres of flood plain on Fairforest Creek between State Secondary Highway 150 and State Secondary Highway 49. One thousand acres of this land will be subject to more frequent flooding, if the erosion and resulting sediment accumulations in the channel are allowed to continue. The lower reaches of the major tributaries in this area will also be affected. Present land use is about 150 acres cultivation, 350 acres of forest land grazed, and 500 acres of forest land. The sand portion of the total sediment being transported will continue to fall out in this area and the channel will aggrade. About 10,000 tons of sand are being deposited in the channel each year. All of these acres are expected to be damaged to some extent by overbank sediment



deposition and resulting swamping. if the present erosion continues.

The uplands of the Sugar Creek drainage area are more intensively cultivated than any other portion of the watershed. Severe erosion and resultant sediment yield have prevented any natural increase of the Sugar Creek channel capacity. Severe sediment and associated swamping damages occur from State Secondary Highway 223 to a point about one mile above State Secondary Highway 52. Ninety acres of flood plain have been damaged by sediment in the area from State Secondary Highway 25 to Fairforest Creek. Forty acres are damaged by swamping. Sediment deposited in forested areas, along with the swamp areas created by sediment concentrations either retards growth or kills some of the more valuable hardwoods. The average annual sediment damages on Sugar Creek are estimated to be \$2,400.

#### Municipal and Industrial Water

Existing supplies of water are adequate for present and foreseeable needs. For example, the annual withdrawal of 35 million gallons per day from the lakes, streams, and wells of Spartanburg County is less than five percent of the county's average streamflow<sup>1/</sup>. Conditions are similar in Union County.

#### Recreation

The 1970 South Carolina Outdoor Recreation Plan (SCORP)<sup>2/</sup> shows a need for nine additional district parks in the Appalachian Planning District. This area consists of Oconee, Pickens, Anderson, Greenville, Spartanburg, and Cherokee Counties. One has been proposed for the southern portion of Spartanburg County. These parks would be about 500 acres in size and have a service area of 10-20 miles radius. No district park needs are shown for Union County. Poor water quality limits the recreational use within Croft State Park and surrounding areas.

#### Fish and Wildlife

Urbanization in the watershed, especially in the areas surrounding the cities of Spartanburg and Union, continues to alter wildlife habitat. Wildlife species in these areas are limited to those found around homes and gardens.

The trend toward conversion of openland to pine, as well as

<sup>1/</sup> USGS, op. cit.

<sup>2/</sup> SCORP-70, South Carolina Department of Parks, Recreation and Tourism, Columbia, South Carolina, 1970.



conversion of hardwood areas to pine, is adverse to all but a few species of wildlife.

The channel on Fairforest Creek, except for the lower six miles, is filled with sand; and the wide, shallow flow is not conducive to a fishery resource. The lower six miles has a relatively deep channel but is under-utilized for fishing because of lack of access.

Pollution from municipal and industrial wastes and petroleum spills have caused foul odors, depleted the oxygen in the water, and caused fish kills on Kelsey Creek.

An appreciable portion of the flood plain is covered with extensive sand deposits. These deposits have been detrimental to some tree species that are of most value to wildlife.

#### Economic and Social

Approximately 74 percent of the commercial farms in the watershed have annual sales of less than \$10,000. Fifty-nine percent of the farms are classified as part-time or part-retirement. Most of the farms in this area are not large enough to be an economical unit which contributes to the high rate of off-farm employment. About 3.4 percent of the total labor force in the two counties is employed in agriculture and only about one-fourth of this is hired labor.

Listed below are unemployment averages for the two counties and the state for the years 1969 through 1973:

<u>Year</u>	<u>Spartanburg</u>	<u>Union</u>	<u>South Carolina</u>
	-----(percent)-----		
1969	3.0	5.4	3.9
1970	3.7	9.1	5.0
1971	3.3	5.7	5.2
1972	2.9	4.1	4.1
1973	2.3	3.5	3.6

SOURCE: South Carolina Employment Security Commission

#### Water Quality Problems

Fairforest Creek is classified by the South Carolina Department of Health and Environmental Control as a "B" stream. This classification is adequate as a source of municipal water after suitable treatment.

Sanitary Sewer Districts 3 and 4 of the city of Spartanburg and Mayfair Mills, located in the Spartanburg area, dump treated waste into Fairforest Creek.

Petroleum spills and industrial waste have created serious problems on Kelsey Creek. Stream fires and fish kills have resulted from these spills. This has limited water based recreation in Lake Tom Moore Craig

in Croft State Park.

Treated wastes from the town of Buffalo are discharged into Buffalo Creek. Union Waste Treatment Plant No. 2 discharges treated waste into Tosch Branch, a tributary of Shoal Creek. There are no known sources of untreated or treated wastes entering Sugar Creek.

#### PROJECTS OF OTHER AGENCIES

There are no known projects which will adversely affect the works of improvement proposed in this plan.

Croft State Park is located in the upper part of the watershed. Land treatment within and upstream from the park will reduce the amount of sediment now being delivered to the park recreation lakes.

Sumter National Forest lands are located near the watershed outlet. Project measures will reduce flooding and sediment damages along Fairforest Creek as it passes through this area.

A Flood Plain Information report, dated February 1968, was prepared for the city of Spartanburg by the Corps of Engineers, U.S. Army, Charleston, South Carolina District. The area covered includes the flood plain of Fairforest Creek and Lawsons Fork Creeks within the city of Spartanburg and a segment of each stream above and below the city. On Fairforest Creek, the information exists between State Secondary Highways 78 and 651. Flooding elevations established were the 50 year, 100 year, and standard project flood.

#### PROJECT FORMULATION

The sponsors of the Fairforest Creek Watershed submitted an application for federal assistance through Public Law 566 on November 7, 1968. The application was processed and planning authorization was given on April 7, 1969.

The sponsors held many public meetings to review the problems and needs of the watershed area and explain various alternative solutions during the planning of this project. The data collected, special reports, and information from interested groups or individuals were reviewed and discussed at the meetings. Reports were prepared and submitted by the South Carolina Department of Parks, Recreation and Tourism; U.S. Fish and Wildlife Service; and the South Carolina Wildlife and Marine Resources Department. A report from the U.S. Forest Service concerning the Sumter National Forest lands involved was also received. Monthly planning status reports were prepared and distributed to those involved in planning the project. Special public meetings were held when the project was authorized for planning and when tentative agreement on project proposals was reached. Interested federal, state, and local

agencies were involved throughout the planning period. The Santee River Basin Report<sup>1/</sup> includes the Fairforest Creek Watershed project in the recommended Early Action Plan. Specific problems and areas were investigated and evaluations made to refine and pinpoint objectives for the project to be installed. Other structural measures to provide flood protection, provide additional surface water storage, and to provide water-based recreational opportunities in the watershed were analyzed. These measures included single purpose and multiple purpose floodwater retarding structures and stream channel work. The sponsors will discourage development within the flood plain that is not compatible with the flood hazard.

#### Objectives

Meetings were held with the sponsors to discuss problems, possible solutions, watershed resource development needs, and the formulation of project objectives. The objectives selected for this project are:

1. Stabilize critically eroding areas and reduce erosion;
2. Establishment and maintenance of necessary land treatment measures which will reduce soil loss to a rate that will permit a high level of productivity to be sustained economically and indefinitely;
3. Provide flood protection and reduce flooding where feasible and eligible for PL-566 assistance;
4. Protect and enhance fish and wildlife resources; and
5. Improve the economic and social environment.

#### Environmental Considerations

Impacts of the proposals, both favorable and adverse, were carefully considered. Adverse impacts were avoided to the maximum degree possible if project objectives could be met. The structure site on Sugar Creek was selected and the structure planned to minimize adverse effects to farming operations and fish and wildlife habitat. Vegetation suitable to the soils, site conditions, and intended uses

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<sup>1/</sup> USDA River Basin Report, U.S. Department of Agriculture, Soil Conservation Service, Columbia, South Carolina, 1973.



will be established on all disturbed areas. There is no known pollution entering Sugar Creek above the proposed structure, and it is not anticipated that any health or water quality problems will arise at the sediment pool. Incidental recreation use of the site will be discouraged until sanitary facilities meeting local and state health requirements are installed.

It is not anticipated that any persons, businesses, or farm operations will be displaced as a result of project installation; however, financial and relocation advisory assistance will be furnished if any displacement becomes necessary.

Land treatment measures planned for the watershed are those that will contribute directly to the preservation and enhancement of the environment. Emphasis will be given to those measures which will reduce soil and water loss, reduce downstream sediment damages, assure proper functioning of the structure, reduce flooding, preserve and improve the habitat for fish and wildlife existing in the watershed, and enhance the beauty of the area.

Representatives of the U.S. Fish and Wildlife Service and the South Carolina Wildlife and Marine Resources Department made a reconnaissance study of the watershed. Recommendations made as a result of this study were considered in formulating the project and original objectives and goals were modified to incorporate them into the final plan.

The drainage area above the structure is 3.6 percent of the total watershed area. Installation of the structure will not have a measurable effect on the normal or low flows in Fairforest Creek below its confluence with Sugar Creek.

### Alternatives

In addition to the various designs, methods of construction, and objectives, the alternatives to the planned project include (1) land treatment only, (2) land treatment measures in combination with floodwater retarding structures and channel work to reduce flooding along Fairforest Creek and its major tributaries, (3) stream channel work with land treatment, (4) land use and treatment compatible with existing flooding, and (5) no project.

Alternate 1 consisted of accelerating the installation of land treatment measures as included in the planned project. Most of the impacts of the application of land treatment measures are discussed under "Effects of Works of Improvement". The estimated cost of this alternative would be \$2,236,300. The benefit would be a reduction in floodwater, sediment, and erosion damages of about 10 percent.

Alternate 2 included land treatment measures and various combinations of floodwater retarding structures and channel work. Fourteen sites were considered. Land use in the watershed has changed from row crops to pasture and forest land over the past two decades resulting in decreased sediment yields to the stream channels.

Tributary channels have degraded and enlarged. Sediment moving from tributary channels has been deposited in Fairforest Creek, and farmers have been forced to abandon the flood plain because of floodwater and sediment damages. An analysis of the watershed showed that, at present, the tributary channels provide a level of protection commensurate with anticipated land uses, except on Sugar Creek.

Alternate 3 included six miles of channel work to provide flood protection to the area receiving benefit from the floodwater retarding structure and land treatment. The benefits would be as described in "Effects of Works of Improvement" and the cost would be \$2,950,000.

Alternate 4 consisted of changing the present use of lands which suffer severe erosion and flood damage to a use which would be more compatible with the existing problem. This alternate would reduce the annual net income on land changed from cropland to less intensive uses and would create a whole new environment for the watershed. Many families would find it necessary to move or expand their operation, in order to maintain their present income. This alternative would reduce monetary damage caused by flooding. Land use regulations would be necessary. At the present time, there are no agencies with authorities necessary to carry out such a program.

Alternate 5 consisted of foregoing the implementation of the project. This would delay the application of land treatment measures. Severe erosion would continue on 2,076 acres. Flooding would continue, forcing less intensive use of many acres. The need to use 85 acres of land to construct the retarding structure and sediment pool and to occasionally inundate an additional 222 acres would be eliminated. The opportunity to realize about \$4,000 in average annual net benefits would be foregone.

#### WORKS OF IMPROVEMENT TO BE INSTALLED

##### Land Treatment Measures

The Spartanburg and Union Soil and Water Conservation Districts have been assisting landowners of the watershed for many years. The conservation programs offered by the districts are based on the wise use, necessary treatment, and proper management of the soil, water, and wildlife resources within the area.

Accelerated application and continued maintenance of land treatment measures are needed. Without adequate land treatment and management the structure cannot be installed. In addition to the funds presently available for technical assistance, \$385,100 will be made available from Public Law 566 funds to accelerate the installation of conservation practices.

Stabilization of 2,076 acres of critically eroding areas within the watershed is needed. These areas are defined as active gullies or other seriously eroding land which are sources of excessive runoff or



sediment contributing to downstream damages. There are 244 acres of gullies to be treated by constructing diversions, installing grade control structures to control gully growth, applying seed, plants, fertilizer, lime, and mulch, sloping banks as needed, and moving and constructing fences. Roadbanks to be treated by preparing seedbeds, providing and applying seed, plants, fertilizer, lime and mulch, sloping roadbanks, and moving and constructing fences amount to 281 acres. On 600 acres, stabilization will be by tree planting. Loblolly pine will be the primary species used. Planting sites will be prepared by applying necessary seed fertilizer, and lime. On the remaining critical areas, approximately 905 acres, treatment will consist of removing terraces, constructing diversions, providing and applying seed, plants, fertilizer, lime and mulch.

In the National Forest approximately 12 acres of gullies and 34 acres of other critically eroding land will be stabilized through brush dam construction and tree planting.

About 500 acres of cropland should be converted to less intensive use to be used within its capability. A combination of measures will be needed on about 900 acres of cropland to receive adequate treatment. These measures include conservation cropping systems, no-till planting, grassed waterways and outlets, open and tile drains, terraces, field border plantings, access roads, and other conservation practices. These measures will provide better control of rainfall runoff, allow a greater quantity of water to enter the soil, and thereby reduce the rates of sheet and gully erosion.

Measures on 3,100 acres of pastureland will consist of pasture and hayland plantings and management, ponds, drainage mains and laterals, land smoothing, and proper grazing use. In addition, other areas will receive partial treatment.

Recreation area improvement and access roads will be established on about 2,000 acres. About 35,000 acres of other land will be developed and managed as wildlife habitat.

Soil buildup will be accomplished on the forest land through stabilization measures and continuing care of the established stands. Forest litter produced under proper forest management and protection is the source of a good humus layer needed to increase infiltration rates and water storage capacity. A forest management program aimed at fulfilling watershed needs and landowner objectives will be followed. The forest lands will be managed for timber, wildlife and recreation needs.

Technical assistance on 24,000 acres of private forest land will be provided by the South Carolina State Commission of Forestry in cooperation with the U.S. Forest Service. This assistance, to include 200 written forest multiple-use management plans is proposed for the five year installation period. Technical assistance on the 4,950 acres of National Forest land within the watershed will be provided by the U.S. Forest Service. About 72,000 acres of forest land are owned by industrial corporations which carry out their own forestry management programs.

Reforestation of understocked stands is necessary on 325 acres to reduce runoff and erosion by developing a protective layer of litter.

Timber stand improvement measures are planned on 13,700 acres. Measures include removal of inferior species and cull trees, release of desirable species for both wood and wildlife needs, stand conversion where practical and beneficial to landowner's objectives, commercial thinnings, and harvest cuttings.

In the National Forest, an additional 34 acres of critical area will be brought up to adequate stocking levels through tree plantings, the primary species being loblolly pine.

The South Carolina State Commission of Forestry will continue the going Cooperative Forest Fire Control Program. The proposed works of improvement will not materially increase the fire hazard or risk. The state goal for the annual fire loss index is 0.25 percent while the present watershed protection goal is 0.20 percent. The average annual fire loss index in the watershed for the period 1961 through 1970 was 0.17 percent. The present fire control program meets the watershed protection standards and intensification is not needed.

#### Structural Measures

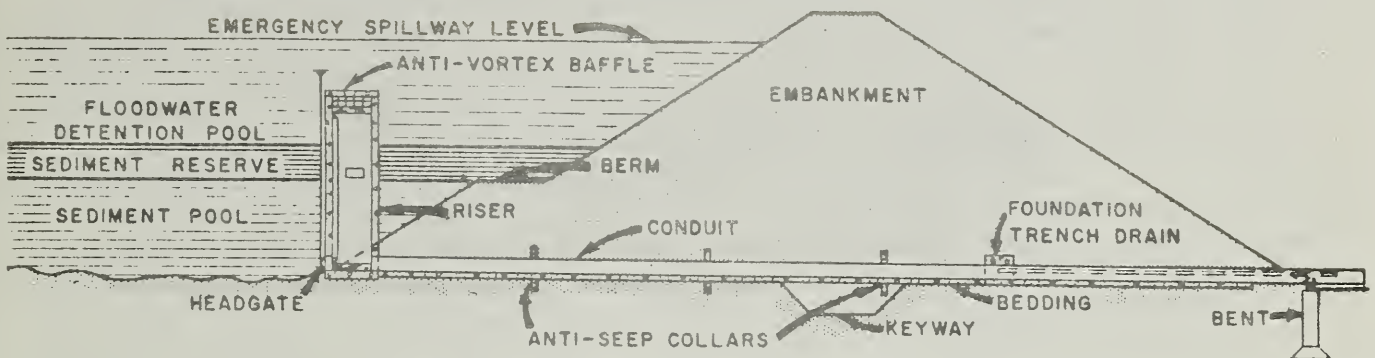
The structural measure consists of one single purpose structure for flood prevention. The planned location of the structural measure is shown on the Project Map. Design data are shown in Table 3.

The total drainage area above the structure is 5,589 acres. It controls 48 percent of the drainage area of Sugar Creek and 3½ percent of the total watershed area.

The structure will consist of an earth fill embankment on a yielding foundation, a reinforced concrete principal spillway, and a vegetated emergency spillway. (See typical section of single purpose floodwater retarding structure.) The principal spillway will consist of a reinforced concrete inlet riser on the upstream side of the structure with a 36 inch reinforced concrete pipe with anti-seep collars placed through the embankment. The pipe will outlet into an excavated plunge basin. Water flowing through the principal spillway plunges down into the pool dissipating much of its erosive energy. The emergency spillway, constructed in earth and vegetated, will have a two percent chance of operation in any year.

The crest elevation of the principal spillway is the expected elevation of sediment accumulation after 100 years. The sediment pool will initially fill with water but will gradually fill with sediment during the life of the reservoir.





TYPICAL SECTION OF SINGLE PURPOSE FLOODWATER RETARDING STRUCTURE

A substantial amount of borrow material will be obtained from the excavated emergency spillway. Other borrow areas are available near the dam within the flood pool.

The crest elevation of the principal spillway is the expected elevation of sediment accumulation after 100 years. The sediment pool will initially fill with water but will gradually fill with sediment during the life of the reservoir.

The sediment pool plus a strip 15 feet horizontally from the elevation of the sediment pool, and construction area will require the removal of all brush and trees on 85 acres. Within this area, 15 acres are presently used for pasture. The remainder of the area involved with the structure and needing easements, 187 acres of forest land and 35 acres of pastureland, will not be altered. As a part of the construction contract, all disturbed areas will be stabilized. A plan for accomplishing this will be developed and incorporated into the final design and used in the operation and maintenance agreement. Vegetation suitable to the soils, site conditions, and intended uses will be established on all disturbed areas. The borrow areas outside of the sediment pool will be planted in trees and the emergency spillway will be planted in Bermuda grass. Grasses and/or legumes will be established on the embankment and the 15 foot cleared strip will revert to its native vegetation. The total area involved with the structure and needing easements amounts to 307 acres.

During construction, the following actions will be taken to control erosion and pollution:

- a. Sprinkling will be used to keep dust in construction areas within acceptable limits.
- b. Sanitary facilities will be provided according to the requirements of the South Carolina Department of Health and Environmental Control.

- c. Measures will be provided at equipment and repair areas to prevent contaminants from reaching streams and ground water.
- d. All operations will be conducted to minimize stream turbidity at and below the structures. Requirements established by the South Carolina Department of Health and Environmental Control will be conformed to during construction. The following erosion and sediment control measures will be applied as needed to the area of land which will be exposed:
  - (1) the contract will include earthmoving equipment time to construct diversions, waterways, and terraces as needed to retard the rate of runoff and control runoff from the construction site;
  - (2) debris basins will be used to minimize sediment leaving the construction site where needed;
  - (3) clearing and grubbing of construction sites and borrow areas will occur in stages as construction progresses;
  - (4) temporary vegetation and/or mulching will be used to protect the soils; segments of work will be completed and protected as rapidly as is consistent with construction schedules; and
  - (5) conduits or bridges will be installed where construction activities cross flowing streams.
- e. Prior to construction, areas will be designated for the disposal of waste material. All debris will be disposed of in accordance with regulations of the South Carolina Department of Health and Environmental Control. The landowners of the area to be cleared will be given the opportunity to salvage trees prior to the beginning of construction.
- f. Vector control will be mutually agreed upon by the Soil Conservation Service, local sponsors, and the South Carolina Department of Health and Environmental Control.

An eight inch pipeline owned by Carolina Pipeline Company crosses the reservoir approximately 1,100 feet downstream from State Secondary Highway 67. The pipeline is above the sediment pool elevation but will have to be weighted to keep it from floating during periods when floodwater is being detained in the reservoir.

Other than moving farm fences within the sediment pool area, no other fixed improvements are involved.

State Secondary Highway 67 crosses the flood pool; however, the bridge elevation is 4.2 feet above the emergency spillway elevation and the road will not need to be altered. A Duke Power Company 500 KVA line crosses the upper part of the flood pool. Since there is adequate vertical distance between the flood pool and the power line, Duke Power Company has agreed to grant a permit to flood their right-of-way.

The planned measure will meet the requirements of local and state health laws. Although the potential exists, no incidental recreation or public access is planned at this site. Sponsors will discourage public use of the site for recreational purposes.

The project will comply with the Historic and Archeological Data Preservation Act, Public Law 93-291, and the Historic Properties Preservation Program, Public Law 89-665 (Section 106). If artifacts or other items of archeological or historical significance are uncovered during construction, the Institute of Archeology and Anthropology and the National Park Service will be notified.

#### EXPLANATION OF INSTALLATION COSTS

Land treatment measures to be applied during the project installation period are estimated to cost \$2,236,300. Of this total, \$760,400 will be paid by PL-566 funds and \$1,475,900 will be provided from other funds. Other funds include \$15,500 for accelerated technical assistance by the South Carolina State Commission of Forestry and \$12,000 for continued technical assistance under the going Cooperative Forest Management Program. The South Carolina State Commission of Forestry will provide \$26,700 to continue the going Cooperative Forest Fire Control Program. The landowners and operators will provide \$151,600 for installation of forestry measures on their lands.

The estimated cost of the Forest Service land treatment program on National Forest land is \$32,700. Of this, \$31,000 will be from supplemental funds and \$1,700 from regular program funds.

The installation cost of Structure 5 is \$220,200 and consists of construction, engineering services, project administration, and land rights. All costs were allocated to flood prevention.

The construction cost of Structure 5 is the estimated cost of all materials and labor necessary for construction. These costs, estimated to be \$125,800, were determined by estimating the quantities required for construction and applying unit costs based on previously constructed projects. Included in the construction cost is a 12 percent contingency



allowance to cover unforeseen items that may be encountered during construction. All construction costs will be paid by PL-566 funds.

Engineering services are estimated to be \$21,100 and consist of the cost of design surveys, geological investigations, design, and the preparation of plans and specifications for the structural measure. These costs will be borne by PL-566 funds.

Project administration costs, estimated to be \$22,800, consist of costs associated with the installation of the structural measure, including the cost of contract administration, government representatives, construction surveys, and necessary inspection during construction. The local sponsors and the Service will each bear the project administration costs they incur which are \$500 and \$22,300 respectively.

No relocation payments or relocation assistance advisory services are anticipated. If relocation becomes necessary, the Fairforest Creek Watershed Conservation District will provide relocation assistance advisory services without PL-566 sharing. The cost sharing percentages applicable to relocation payments are based upon the ratio of PL-566 funds and other funds to the total project costs, less relocation payments. These costs will be shared by PL-566 and other funds, 37.8 percent and 62.2 percent respectively.

Land rights costs include all land values and expenditures made in acquiring easements and rights-of-way, and all costs associated with weighting the eight inch pipeline and altering farm fences affected by the structural measure. These total costs are estimated to be \$50,500 and will be paid by other than PL-566 funds.

The total PL-566 cost for structural measures is \$169,200, and other cost amounts to \$51,000 (Table 2).

Estimated expenditures by years:

Project Year	PL-566 Funds		Other Funds	
	Structural Measures	Land Treatment	Structural Measures	Land Treatment
First	\$ 21,100	\$ 190,000	\$ 51,000	\$ 369,000
Second	148,100	190,000	-	369,000
Third	-	152,000	-	295,000
Fourth	-	152,000	-	295,000
Fifth	-	76,400	-	147,900
TOTAL	\$ 169,200	\$ 760,400	\$ 51,000	\$1,475,900

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion and Sediment

Installation of land treatment measures will reduce sheet erosion from 3.1 to 1.7 tons per acre. Erosion from critical areas, including gullies, will be reduced by 40 tons per acre annually. The project will reduce the average annual sediment yield from 68,967 tons to 34,000 tons. This was computed at the intersection of Fairforest Creek and State Secondary Highway 49. A suspended sediment concentration of 245 milligrams per liter, is estimated at this point without the project. After project installation, the concentration will be near 120 milligrams per liter. The reduction of sediment deposition in the channels will reduce downstream flooding. The floral and faunal habitat will be improved by reducing the suspended sediment concentrations. Except for Sugar Creek, the flood hazard will be unchanged for most of the flood plain. Use of the flood plain should be compatible with the flood hazard to avoid serious flood losses. Flood plain shown on the project map is based on soils information and stereoscopic study and is not related to flood frequency elevations.

The following table shows the discharge, stage, and area flooded with and without the project for Sugar Creek:

Item	Without Project			With Project		
Frequency (yr.)	100	3	1	100	3	1
Discharge (cfs)	2,717	1,079	618	1,980	803	458
Stage (ft.)	7.8	3.5	1.2	6.4	2.2	0.0
Area flooded (ac.)	391	287	93	190	22	0

Floodwater Retarding Structure 5 will reduce the acres flooded on Sugar Creek during the 100 year frequency storm by 52 percent, the acres flooded from the three year frequency storm by 92 percent, and will eliminate flooding by the one year frequency storm.

After the project is installed 22 acres on Sugar Creek will continue to be flooded by the three year frequency storm. This area should be confined to pasture, hay, or timber production to limit flood damages. The remaining 369 acres will have a degree of protection adequate for row crop production or any less intensive use.

The land use in Sugar Creek flood plain is 98 acres of corn, 156 acres of pasture, 132 acres of woods, and five acres of miscellaneous. With the project installed, it is projected that the land use will be 125 acres of corn, 200 acres of pasture, 61 acres of woods and five acres of miscellaneous. The increased acreage of corn and pasture is

based on anticipated restoration of previously cropped land. No new land is expected to be brought into production.

Twenty-two landowners will be benefited by reduced flooding on 391 acres on Sugar Creek. Floodwater damage to crops, pasture, fences, and roads will be reduced 90 percent. Sediment damages will be reduced by 50 percent. Indirect damages will be reduced by 80 percent. Total damages on Sugar Creek will be reduced 81 percent by the structure. The following are sediment damages and the expected recovery on Sugar Creek:

<u>Acres Damaged</u>	<u>% Damaged</u>	<u>% Recovery</u>
20	60	70
36	50	80
3	40	80
61	10	100
16	5	100

Swamping damages and the expected recovery are as follows:

<u>Acres Damaged</u>	<u>% Damaged</u>	<u>% Recovery</u>
90	20	90
40	10	100

#### Fish and Wildlife

The 2,076 acres of critical area treatment planned for the watershed will have an appreciable and favorable effect on fish and wildlife resources. These critical areas are major sources of silt. The fishery along the lower reaches of Fairforest Creek is gradually being lost due to siltation of the channel. Frequent muddiness of the water is detrimental to fishing. The same type of influx of silt and muddy water is damaging farm ponds in the watershed.

Most of the critical areas have little if any vegetation; therefore, they provide nothing in the way of wildlife food and cover. Vegetation used to stabilize the critical areas will be beneficial to some form of wildlife as food and/or cover. With the increasing number of people who enjoy observing all kinds of birds or wild animals, it is important to provide habitat for all wildlife species and not only those classified as game or providing an economic return.

A possible adverse effect of critical area plantings on roadbanks will be a slight increase in the kill of wildlife by highway traffic. Species as cottontails and bobwhite are particularly vulnerable when suitable cover attracts them to the edges of roadways. However, the



benefits of such plantings are expected to outweigh any slight increase in losses from traffic.

The floodwater retarding structure will reduce the sediment load in Sugar Creek below the structure. This should benefit rheophilic organisms and thus increase the life supporting ability of the stream through longer periods of water release.

The spill from the pool may cause an increase in water temperature downstream. This will be of no consequence since the life forms present downstream are those normal to warm water habitat.

The structure will not have any adverse effect upon the fishery resource at the lower end of Fairforest Creek. The portion of the channel of Sugar Creek which will be inundated by the structure provides no fishing.

The structure will enhance the fisheries resources of the watershed. Suitable habitat for bluegill, shellcracker, largemouth bass, and channel catfish will be created.

The temporary floodwater storage above the normal pool will not have significant effect on motile wildlife species. The water will rise slowly enough for all such species to move out of the flood pool area. Most wildlife food and cover plants can survive the temporary inundation. Nests of ground nesting birds and mammals will be destroyed if the flooding should occur during their nesting season. However, the reduction of flooding in the flood plains below the structure will reduce the present losses of small mammals and ground nesting birds in the flood plain.

The reduction of the flood hazard below the structure will encourage the clearing of about 71 acres of forested flood plain. In keeping with present land uses in this watershed, any developments of this sort are almost certain to be for improved pasture rather than for cropland.

Although the sediment pool will provide only a meager supply of waterfowl food, it will provide good resting, loafing, and roosting areas for waterfowl. This will enhance conditions for the duck flight along Fairforest Creek by providing an additional dispersal area for ducks. The pool will be located about six miles south of the 50 acre "duck marsh" on Fairforest Creek, described under "Watershed Resources - Environmental Setting". It can, therefore, serve as a refuge when there is intensive hunting pressure in the marsh.

The edges of the sediment pool will provide an extensive amount of shoreline habitat favorable to herons, egrets, and shorebirds. A hedge of smooth alder will develop naturally along shores where there is some degree of slope upwards from the water's edge. This hedge will provide travel lanes for raccoon and mink and cover for a variety of bird species.

Flatter edges of the sediment pool, where the water "feathers out" on the shore, will become established in willows. These areas are of low value for wildlife habitat.

Muskrats are certain to become established in the impoundment, but they cannot endanger a structure of this size. Their presence will be beneficial in reducing cattails and other emergent vegetation which



they use for food. Muskrat pelts are periodically in demand and they will be a useful fur resource in the future.

Clearing for the sediment pool, embankment, and spillway will be necessary. About two-thirds of this clearing, or approximately 57 acres, will be on flood plain lands, and thus will be lost as forested bottomland wildlife habitat. However, the impact will be slight as this is less than a fraction of one percent of similar forested bottomland wildlife habitat in the watershed. Thirteen acres of upland forest habitat will also be cleared.

Reduction of forest land results in an initial average loss of 934 cubic feet of growing stock per acre and an average loss of sustained yield production of 0.64 cords per acre per year over the life of the project under current management levels.

#### Archeological, Historic, and Scientific

The Institute of Archeology and Anthropology, University of South Carolina, has made a field study in the proposed structure and impoundment area. Their investigations<sup>1/</sup> indicate that the project will not encroach on any archeological values<sup>1/</sup>. The South Carolina Department of Archives and History has determined that no properties listed in the National Register of Historic Places, or on state surveys, will be affected by the planned project<sup>2/</sup>.

The proposed works will not change the existing responsibility of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

#### Economic and Social

Employment opportunities will be increased as a result of the project. Underemployed farmers will be able to better utilize flood plain land for more efficient farming operations. Installation of land treatment practices will create new jobs and utilize underemployed labor. It is estimated that construction of the retarding structure, installation of land treatment practices, increased yields, and the multiplier effect will create 315 man years of labor.

The increase of jobs and capital will improve the living condition of

1/ An Archeological Survey of a Portion of The Fairforest Creek Watershed, Union County, South Carolina, T. L. Bianchi, Institute of Archeology and Anthropology, University of South Carolina, Columbia, South Carolina, March 1975.

2/ Letter from Charles E. Lee, State Historic Preservation Officer, S.C. Department of Archives and History, Columbia, South Carolina, March 4, 1975.

residents of the watershed.

#### PROJECT BENEFITS

Average annual benefits evaluated for project justification are estimated to be \$17,200 (Table 6). These benefits include damage reduction, \$9,100; more intensive land use, \$3,500; redevelopment, \$1,900; and secondary, \$2,700.

Damage reduction benefits (Table 5) include \$7,770 from the reduction of floodwater on crops, pastures, and other agricultural property. Benefits from reduction of sediment damage amount to \$1,760 annually. Indirect benefits are estimated to be \$540 annually. Land treatment measures account for \$1,000 of the total damage reduction benefits.

Benefits from more intensive agricultural use of the flood plain are expected to be \$3,500 annually.

Local secondary benefits are valued at \$2,700 annually. These benefits accrue as a result of increased business activity and an improved economic condition. Secondary benefits from a national viewpoint were not considered in the economic evaluation of the project.

Redevelopment benefits are estimated to average \$1,900 annually during the life of the project. These benefits accrue from added employment during project construction as well as operation and maintenance.

Benefits that will result from the land treatment program include decreased erosion, lower sediment yields, improved hydrologic conditions, less storm runoff, increased productivity, and improved habitat for fish and wildlife resources.

#### COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measure, including operation and maintenance, is estimated to be \$13,200. This measure is expected to produce average annual benefits of \$17,200. The ratio of average annual benefits to average annual costs is 1.3 to 1 (Table 6). The benefit-cost ratio without local secondary benefits is 1.1 to 1.



### PROJECT INSTALLATION

The watershed project is planned for a five year installation period. Land treatment measures will be established by landowners cooperating with the Spartanburg and Union Soil and Water Conservation Districts. The soil and water conservation districts, with technical assistance from the Soil Conservation Service, will assist with the planning and application of these measures. This assistance will be accelerated to assure application of planned measures within the five year project installation period.

Landowners having forest land will be encouraged to apply and maintain the improved forestry measures. The U.S. Forest Service, by and through the South Carolina State Commission of Forestry, will provide private landowners with small tracts technical assistance for the application of forestry measures. A forester trained in watershed management will be assigned to the watershed to guide and assist the landowners in the installation of the planned forestry measures. One of the first objectives of the forester will be the preparation of forest land multiple-use management plans which would supplement existing conservation plans and assist decision making.

The South Carolina State Commission of Forestry, in cooperation with the U.S. Forest Service, will assist the soil and water conservation district cooperators with tree planting. This will be accomplished in accordance with conservation plans developed with assistance from the local soil and water conservation districts and the Soil Conservation Service.

Critical area stabilization will be accomplished through a division of work. The Service will construct diversions, remove terraces, install grade control structures to control gully growth, provide and apply seed, plants, fertilizer, lime, and mulch including one follow-up supplemental treatment. The districts will prepare seedbeds, remove terraces, slope banks as needed, construct fences, and provide seedlings and mulch. The value of the work to be performed by using PL-566 funds does not exceed cost sharing rates applicable under other going programs.

The Fairforest Creek Watershed Conservation District will be responsible for obtaining land rights required for the installation of the structural measure. The sponsors have the necessary legal authority to acquire land rights and agree to use such authority, if necessary.

The Service will provide the engineering services for the construction of the structural measure.

No relocation of persons, businesses or farming operations is anticipated. If relocation is necessary, the Fairforest Creek Watershed Conservation District will (1) provide personally or by first class mail, written notice of displacement and appropriate application forms to the residents displaced, (2) assist in filing applications, (3) review and approve applications for relocation assistance,

(4) review and process grievances in connection with displacements, (5) make relocation payments, and (6) provide such relocation assistance advisory services as may be needed in connection with the relocation of displaced persons. The Fairforest Creek Watershed Conservation District will be responsible for obtaining appraisals which is a prerequisite for obtaining all land rights not donated.

The sponsors have requested that the Service administer the contract for construction of Structure 5. The Fairforest Creek Watershed Conservation District will deal with the Service during the construction of Structure 5 and the treatment of critical areas.

Construction of the structural measure is planned for the second project year. This can be changed contingent upon securing of land rights, availability of funds and installation of necessary land treatment above the structure.

#### FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the planned works of improvement described in the work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566), as amended. This financial and technical assistance to be furnished by the Soil Conservation Service and the U.S. Forest Service is contingent upon appropriation of funds for this purpose. Organizational expenses which are incurred by the local sponsoring organizations will be provided for in the annual budgets of the Spartanburg and Union Soil and Water Conservation Districts and the Fairforest Creek Watershed Conservation District.

Prior to the Service providing financial assistance for the construction of Structure 5, the following conditions must be met: (1) the Spartanburg and Union Soil and Water Conservation Districts must obtain agreements to carry out soil and water conservation plans with necessary conservation measures on not less than 50 percent of the drainage area above Structure 5, (2) adequate treatment measures must be applied on at least 75 percent of the critical sediment sources above the structural measure which, if uncontrolled, would materially increase the cost of operation and maintenance of the structural measure, (3) all needed land rights must be obtained, and (4) a specific operation and maintenance agreement must have been executed.

The cost of installing land treatment measures which are normally included in conservation plans will be borne by individual landowners. Technical assistance will be provided by the Soil Conservation Service and the South Carolina State Commission of Forestry, in cooperation with the U.S. Forest Service, with funds from PL-566 and going programs for the installation of these land treatment measures.

Based on a partial survey of landowners involved in Site 5, the



sponsors expect all land easements to be donated. The cost of weighting the eight inch pipeline will be paid from funds raised by a tax on real property within the Union County portion of the watershed. The sponsors have power of eminent domain and taxation authority.

Land treatment costs, including critical area stabilization, on National Forest land will come from regular program funds.

#### PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the owners and operators of the land on which they are installed, in cooperation with the Spartanburg and Union Soil and Water Conservation Districts. The South Carolina State Commission of Forestry, in cooperation with the U.S. Forest Service, will furnish the technical assistance to small private landowners and operators and Croft State Park necessary for forest land treatment measures under the going Cooperative Forest Management Program. They will also continue to furnish fire protection under the Cooperative Forest Fire Control Program. The industrial owners, however, will provide the technical assistance on their lands. The U.S. Forest Service will provide the technical assistance on the involved National Forest acreage.

A specific maintenance agreement between the Service and the Fairforest Creek Watershed Conservation District will be executed prior to issuing a bid invitation for construction of Structure 5. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with PL 566 financial assistance. The Fairforest Creek Watershed Conservation District will operate and maintain the structural xmeasure. This will include fertilizing, maintaining, and controlling the vegetation on the embankment; repair of damage to the principal spillway, emergency spillway, and embankment; and removal of floating logs and debris which may affect the operation of the structure. The Soil Conservation Service will assist the sponsors in developing a site conservation plan dealing with the specific details of maintenance. The development of the plan will be in accordance with the South Carolina Watershed Operations and Maintenance Handbook, prepared by the Soil Conservation Service.

Funds for operation and maintenance, estimated to cost \$300 annually, will be obtained from a tax on real property within the Union County portion of the watershed. Since the sponsors do not plan to allow incidental recreation by the public, they will control access to prevent unsanitary conditions around the sediment pool.

During periods of low stream flow, water will be released from the reservoir through a gate installed on the principal spillway riser at a rate at least equal to the inflow to provide for downstream use and to maintain a beneficial equilibrium of biological organisms. The Fairforest Creek Watershed Conservation District will be responsible

for releasing water.

For three years following installation of the structural measure, the Service and the Fairforest Creek Watershed Conservation District will make joint inspections annually, after unusually severe floods, or after the occurrence of any other unusual event that might adversely affect the structural measure. Inspection after the third year will be made annually by the watershed district directors. One copy of their report will be sent to the Service representative and one copy filed by the sponsors and made available for authorized inspection.

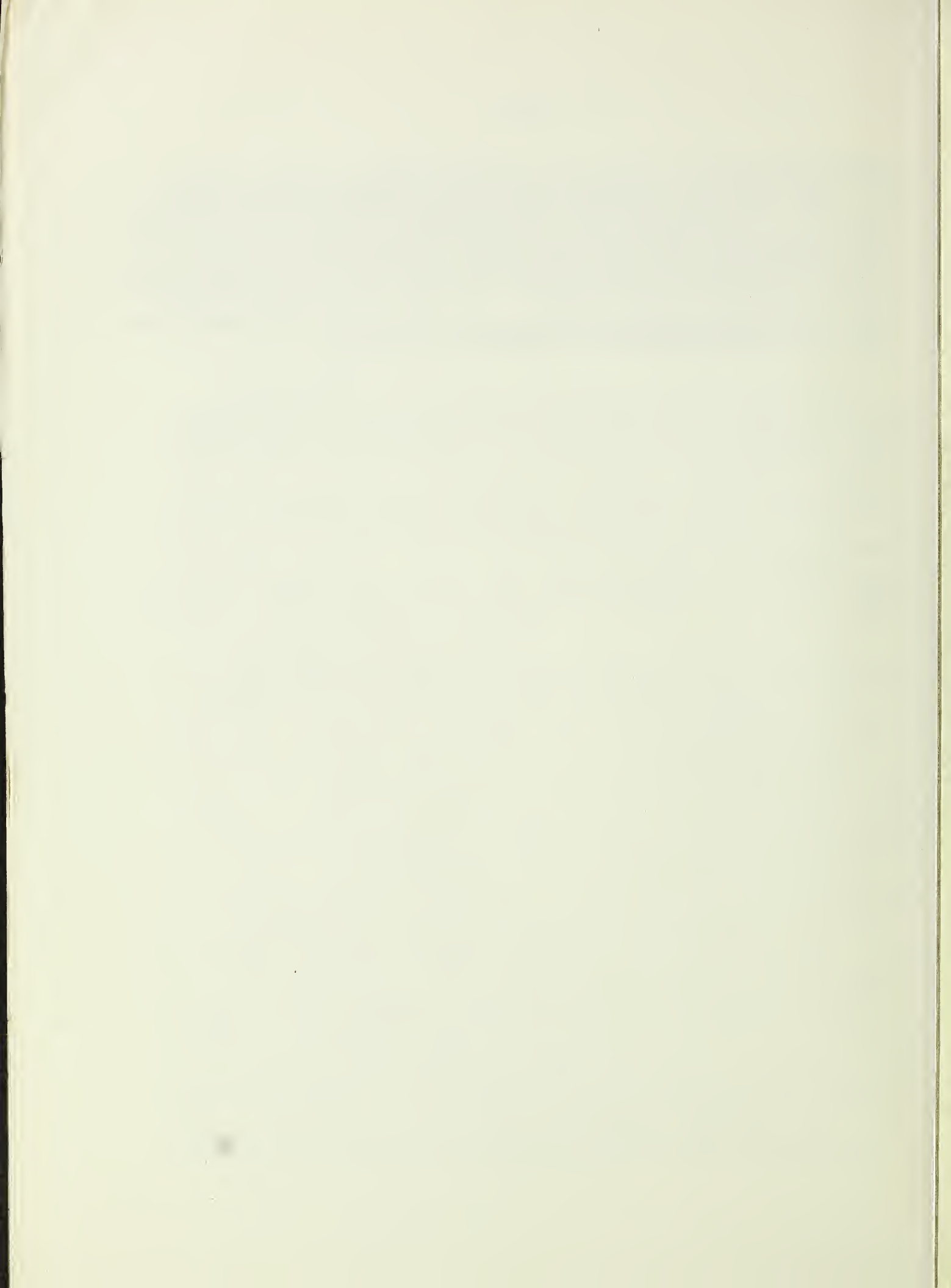


TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Fairforest Creek Watershed, South Carolina

Installation Cost Item	Unit	Estimated Cost (Dollars) 1/									
		Number		PL-566 Funds				Other			
		Federal Land	Non-Federal Land	Non-Federal Land		Total	FS 2/	Federal Land		Non-Federal Land	Total
				SCS 2/	FS 2/			FS 2/	SCS 2/		
<b>LAND TREATMENT</b>											
Land Areas 3/											
Cropland	Ac.	-	900	-	-	-	-	-	72,100	-	72,100
Pastureland	Ac.	-	3,100	-	-	-	-	-	448,000	-	448,000
Forest land	Ac.	34	14,025	-	-	-	-	1,700	-	151,600	153,300
Urban & built-up	Ac.	-	700	-	-	-	-	-	86,600	-	86,600
Other land											
Wildlife	Ac.	-	35,000	-	-	-	-	-	26,800	-	26,800
Recreation	Ac.	-	2,000	-	-	-	-	-	228,000	-	228,000
<b>Individual Practices</b>											
Going Coop. Forest											
Mgmt. Program											
Going Coop. Forest											
Fire Control											
Critical Area											
Stabilization											
Roadsides	Ac.	-	281	55,100	-	55,100	-	-	169,700	-	169,700
Gullies	Ac.	12	558	193,000	23,700	216,700	9,000	-	84,900	9,800	103,700
All other	Ac.	34	1,191	83,500	20,000	103,500	22,000	-	31,700	7,500	61,200
Technical Assistance				323,400	61,700	385,100	-	-	72,300	15,500	87,800
TOTAL LAND TREATMENT	xxx			655,000	105,400	760,400	32,700	-	1,220,100	223,100	1,475,900
<b>STRUCTURAL MEASURES</b>											
Construction											
Floodwater Retarding											
Structure	No.		1	125,800	-	125,800	-	-	-	-	125,800
Subtotal-Construction				125,800	-	125,800	-	-	-	-	125,800
Engineering Services				21,100	-	21,100	-	-	-	-	21,100
Project Administration											
Construction Inspection				21,100	-	21,100	-	-	-	-	21,100
Other				1,200	-	1,200	-	-	500	-	1,700
Subtotal-Administration				22,300	-	22,300	-	-	500	-	22,800
Other Costs											
Land Rights				-	-	-	-	-	50,500	-	50,500
Subtotal-Other				-	-	-	-	-	50,500	-	50,500
TOTAL STRUCTURAL MEASURES				169,200	-	169,200	-	-	51,000	-	220,200
TOTAL PROJECT				824,200	105,400	929,600	32,700	-	1,271,100	223,100	2,456,500

1/ Price base - 1974.

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

February 1975





TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT  
(at time of Work Plan preparation)

Fairforest Creek Watershed, South Carolina

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
<u>LAND TREATMENT</u>			
Conservation Cropping Systems	Ac.	2,600	3,250
Grassed Waterway or Outlet	Ac.	56	4,480
Terraces, Gradient	Ft.	1,600,000	60,000
Terraces, Parallel	Ft.	103,000	10,300
Drainage Field Ditch	Ft.	74,000	48,100
Drainage Main or Lateral	Ft.	29,000	18,850
Field Border	Ft.	32,000	800
Diversion	Ft.	35,000	1,750
Pasture & Hayland Management	Ac.	7,000	140,000
Pasture & Hayland Planting	Ac.	14,000	700,000
Pond	No.	400	600,000
Wildlife Habitat Management	Ac.	16,000	12,000
Tree Planting	Ac.	27,900	642,700
Forest Land Release	Ac.	1,000	20,000
Cooperative Forest Fire Control	Ac.	80,192	80,200
<hr/>			
TOTAL	xxx	xxx	2,342,430

1/ Price base - 1974.

February 1975





TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Pairforest Creek Watershed, South Carolina

Item	(Dollars) 1/					
	Installation Cost - PL 566 Funds			Installation Cost - Other Funds		
	Con- struction	Engi- neering	Total P.L. 566	Con- struction	Engi- neering	Land Rights
Floodwater Retarding Structure 5	125,800	21,100	146,900	-	-	50,500 2/
						50,500
						197,400
Subtotal	125,800	21,100	146,900	-	-	50,500
Project Administration			22,300			500
GRAND TOTAL	125,800	21,100	169,200	-	-	51,000

1/ Price base - 1974

2/ Includes \$4,400 for weighting a pipeline and \$2,200 for surveys and legal fees.

February 1975



TABLE 3 - STRUCTURAL DATA  
STRUCTURES WITH PLANNED STORAGE CAPACITY

Fairforest Creek Watershed, South Carolina

Item	Unit	Structure Number 5
Class of Structure		b
Drainage Area	Sq. Mi.	8.73
Curve No. (1-day) (AMC II)		76
Elevation Top of Dam	Ft.	501.5
Elev. Crest Emergency Spillway	Ft.	495.0
Elev. Crest Principal Spillway Inlet	Ft.	480.0
Maximum Height of Dam	Ft.	39
Volume of Fill	Cu. Yds.	34,600
Total Capacity <u>1/</u>	Ac. Ft.	2,227
Sediment Submerged	Ac. Ft.	328
Sediment Aerated	Ac. Ft.	72
Retarding	Ac. Ft.	1,827
Surface Area		
Sediment Pool	Acres	62
Retarding Pool <u>1/</u>	Acres	203
Principal Spillway Design		
Rainfall Volume (areal) (1 day)	In.	6.70
Rainfall Volume (areal) (10 day)	In.	11.50
Runoff Volume (10 day)	In.	6.14
Capacity (Max.)	cfs.	156
Frequency of Operation - Emer. Spillway	% Chance	2
Size of Conduit	In.	36
Emergency Spillway Design		
Rainfall Volume (ESH) (areal)	In.	8.50
Runoff Volume (ESH)	In.	5.61
Storm Duration	Hrs.	6
Type		veg.
Bottom Width	Ft.	175
Velocity of Flow (Ve)	Ft./Sec.	6.6
Slope of Exit Channel	Ft./Ft.	0.03
Max. Reservoir Water Surface Elevation	Ft.	497.1
Freeboard Design		
Rainfall Volume (FH) (areal)	In.	15.10
Runoff Volume (FH)	In.	11.88
Storm Duration	Hrs.	6
Max. Reservoir Water Surface Elevation	Ft.	501.2
Capacity Equivalents		
Sediment Volume	In.	0.86
Retarding Volume	In.	3.92

1/ Crest of emergency spillway.

February 1975





TABLE 4 - ANNUAL COST

Fairforest Creek Watershed, South Carolina

Evaluation Unit	(Dollars) 1/		
	Amortization of Installation Cost 2/	Operation and Maintenance Cost	Total
Floodwater Retarding Structure 5	11,600	300	11,900
Project Administration	1,300		1,300
TOTAL	12,900	300	13,200

1/ Price base: 1974.  
2/ Amortized at 5 7/8 percent interest rate for 100 years.

February 1975



TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Fairforest Creek Watershed, South Carolina  
Sugar Creek Tributary Only

Item	(Dollars) 1/ Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	8,000	300	7,700
Other Agricultural	80	10	70
Subtotal	8,080	310	7,770
Sediment			
Overbank deposition	1,900	600	1,300
Swamping	500	40	460
Subtotal	2,400	640	1,760
Indirect	635	95	540
TOTAL	11,115	1,045	10,070

1/ Price base - current normalized for crop and pasture; 1974 prices for all other.

February 1975





TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

## Fairforest Creek Watershed, South Carolina

Evaluation Unit	(Dollars)					Average Annual Cost 2/	Benefit Cost Ratio
	AVERAGE ANNUAL BENEFITS 1/						
	Damage Reduction	More Intensive Land Use	Redevelopment	Secondary	Total		
Sugar Creek	9,100 3/	3,500	1,900	2,700	17,200	11,900	1.4 to 1
Project Administration						1,300	
GRAND TOTAL	9,100	3,500	1,900	2,700	17,200	13,200	1.3 to 1
1/ Price base - current normalized for crop and pasture damage reduction; 1974 prices for all other.							

1/ Price base - current normalized for crop and pasture damage reduction; 1974 prices for all other.

2/ From Table 4.

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$1,000 annually.

February 1975



## INVESTIGATIONS AND ANALYSES

### Land Use and Treatment

Present land use was determined from soil and water conservation district reports, surveys, and field studies. Estimates of future land use and treatment measures were made on the basis of the people involved, the land within the watershed, and present trends in the community. Needed land use adjustments based on land capabilities were considered in arriving at the land treatment measures planned for the watershed.

The costs of installing the land treatment measures were developed by the Soil Conservation Service, the South Carolina State Commission of Forestry, and the U.S. Forest Service. Technical assistance costs were based on the present costs of the going soil and water conservation district program and going Cooperative Forest Management Program. Costs of installing land treatment measures were based on present prices paid by landowners and operators in the locality. The amount of private forest land treatment measures needed to meet treatment goals was based on a field survey of the watershed adjusted for expected participation during the installation period. The effects of the proposed works of improvement on fire hazard and risks were analyzed. The estimates for the amount of all other land treatment measures were developed by the Soil Conservation Service.

A committee consisting of the district conservationists, area conservationists, and members of the Watershed Planning Staff itemized the agricultural treatment needs, made cost estimates for each item of work including labor and materials, and divided the items of work between PL-566 funds and other funds. Separate cost estimates were made for each type of critically eroding area. Total costs of jobs proposed for PL-566 funds were compared to similar work being performed under other federally cost-shared programs to make sure that the cost-share rate in this watershed did not exceed other going programs.

### Structures

Vertical control necessary to survey valley cross sections for evaluating flooding problems and developing a topographic map of the reservoir site was based upon mean sea level datum as established by U.S. Coast and Geodetic Survey and U.S. Geological Survey. Temporary bench marks were established throughout the watershed.

Topographic maps with five foot contour intervals were made of the area of the floodwater retarding site. The map was made using low level aerial photography and the stereoplotter. The map was used to develop stage-area and stage-storage curves and is adequate for final design.

The floodwater retarding structure was designed in accordance with SCS Engineering Memorandum 27. The structure was classified to establish its design criteria by considering the damage that might result from a sudden major breach of the earth dam embankment. The structure was



classified as Class b. Flood storage was determined, using the computer by flood routing the 10-day hydrograph for the principal spillway design storm. Discharge rates were held to near the minimum that would empty the pool within 10 days. The emergency spillway and freeboard hydrographs were also routed using the computer. The principal spillway and the emergency spillway were proportioned to determine the most economical structure.

Investigations of abutments, the foundation, and borrow areas were made by surface inspection and by hand augering. These investigations indicate that foundation conditions for the embankment are good and an emergency spillway can be constructed in earth adjacent to the right abutment. A substantial amount of borrow material will be obtained from the excavated emergency spillway. Other borrow areas are available near the dam within the flood pool.

A second potential emergency spillway location is through a saddle near the structure's right abutment. Hand auger borings were made in this area and indicated probable rock excavation. Both this spillway and the spillway adjacent to the right abutment should be investigated during final design.

The geologic formation at Structure 5 consists of sericite schist. Surficial deposits within the flood plain are silty sands and sandy silts. Soils occurring on the valley slopes are silty clays and sandy silts. Many of the soils contain rock fragments. The soils to be used in the embankment will be clays and silts from hillside borrow areas and the expected emergency spillway excavation.

The site is located in Seismic Risk Area 2. Design features will be incorporated into the structure to minimize the risk of failure of the earth fill embankment should an earthquake occur.

#### Hydraulics and Hydrology

An analysis of the watershed was made using procedures in the National Engineering Handbook, Section 4, Watershed Planning. This analysis was used to develop physical data for the economic evaluation and design of the proposed structure.

The partial duration series of rainfall was developed using rainfall data from the U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States".

The weighted average curve numbers were determined by applying information obtained from local observation, the U.S. Forest Service, district conservationists, and soil scientists to procedures outlined in National Engineering Handbook, Section 4, Watershed Planning. Runoff was determined by applying rainfall amounts to the weighted average curve number.

The principal spillway, emergency spillway, and freeboard hydrographs were developed in accordance with Chapter 21 of the National Engineering Handbook, Section 4, Watershed Planning.

Water surface profiles, using the I.B.M. 1130 Computer, were used to determine stage-discharge relationships for 87 cross sections. Stage-area flooded data, by depth increments, for 53 of these cross sections were also calculated by the computer for use in the economic evaluations.

Due to limited flood plain land use and/or lack of local interest, no analysis of the watershed above the Croft State Park was made. All tributaries to Fairforest Creek below the park area which have significant flood plain land use were analyzed.

The 1, 10, 33, 50, 100, and 300 percent chance storms were routed through 75 cross sections using the convex method of routing by the I.B.M. 1130 Computer. The future without project routings along with the ECON-2 analysis, revealed that without project, damages will not be sufficient to justify any structural works of improvement, except one dam on Sugar Creek.

### Geology

Existing geological reports and maps were reviewed. Estimates of sediment storage requirements were made in accordance with SCS procedures. The sediment storage was computed using a submerged unit weight of 74 pounds per cubic foot and an aerated weight of 92 pounds per cubic foot. Aerated unit weights were considered similar to those of upland samples. Submerged unit weights were estimated, using previous sediment survey data collected by the Soil Conservation Service. The estimated aerated sediment for Structure 5 is 18 percent. This estimate is based on sediment texture, delivery ratio, shape and size of the reservoir, and the entry slope.

Critically eroding areas were mapped using aerial photographs in conjunction with field inspections. The areas selected were significantly contributing sediment to the stream channels. This sediment would be a detriment to any proposed watershed structure built on these channels. Land shaping and intensive vegetation programs are needed to stabilize these critical areas.

A reconnaissance surface inspection of the physical damages to the watershed flood plains was made. A subsurface inspection of the Sugar Creek flood plain below Structure 5 was made according to the "valley section method". Damages were summarized by evaluation reaches and adjusted for recoverability of productive capacity. Estimates of recoverability were developed from field studies and interviews with landowners. Calculations of reduction in sediment yield by reaches were made to determine the reduction due to structural and land treatment measures.

Estimates of present and future with project, average annual suspended sediment concentrations were made for Fairforest Creek at State Secondary Highway 49 crossing. Present concentrations were calculated for several other channel drainage areas. These estimates were made following procedures outlined in Chapter VIIA of the "Guide to Sedimentation Investigations", prepared by the E&WP Unit of the South Technical Service Center, revised July 1968.



### Economics

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service in benefit-cost evaluation of land and water resource projects. Basic data were obtained from landowners, agricultural workers, experiment stations, county officials, state highway department personnel, university, and USDA publications.

Current normalized prices were used in crop and pasture benefit computations. Current (1974) prices were used for estimating all other benefits, operation and maintenance costs and installation costs. The costs of the structural measure were amortized over a 100 year period using 5 7/8 percent interest rate.

Owners and operators of flood plain land were interviewed to determine land use and to estimate yields with various degrees of protection from flooding. These data were summarized for more than 20 evaluation reaches. Damage values were derived from these summaries and from cost-price information. Yields used in the analysis are those that would normally be expected in the future without and with project. Floodwater damage reduction benefits were computed by the ECON-2 computer program.

Benefits from restoration of former productivity were estimated on the basis of increases in net income due to reduction in flood hazards. Associated costs and increased damages due to higher damageable values with the project were deducted from gross benefits. Special attention was given in the evaluation procedure to avoid the possibility of double counting benefits.

Sediment damage reduction benefits were estimated on the basis of increased net income which is expected to accrue as a result of recovery of land damage. An equivalent of 40 acres damaged 100 percent by overbank deposition and 22 acres damaged 100 percent by swamping were used as the basis of deriving the benefits on Sugar Creek. Consideration was given to the degree of recovery that can be expected and the probable time required for recovery.

More intensive land use benefits were calculated on the basis of expected increase in crop yields. This increase in yield level would result from increased use of fertilizers and better managerial practices made profitable by reducing the flood hazard. Future flood damages to these higher damageable values were deducted from gross benefits.

Future flood plain use on Sugar Creek without the project is estimated to be 98 acres of crops, 156 acres of pasture, and 137 acres of forests and miscellaneous. Future flood plain use with the project is estimated to be 125 acres of crops, 200 acres of pasture, and 66 acres of forests and miscellaneous.

The soils of the flood plain are mostly Class IIw and IIIw. The planned land use is within the capabilities of the flood plain soils.

Indirect damages were estimated to be 10 percent of agricultural and sediment damages and 20 percent of nonagricultural damages.

Redevelopment benefits resulting from installation of the project

measure are based on utilization of unemployed and underemployed local labor. Wage payments to local labor during construction were estimated to be 25 percent of the construction costs. This value was amortized at 5 7/8 percent interest for 100 years to arrive at annual benefits. Fifty percent of the operation and maintenance costs was used as the value of annual wages paid to local labor. This value was treated as a decreasing annuity for 20 years at 5 7/8 percent interest and converted to an annual equivalent over the project life.

The value of local secondary benefits stemming from the project were estimated to be 10 percent of the direct primary project benefits. Indirect and redevelopment benefits were excluded when computing secondary benefits. The value of local secondary benefits induced by the project were estimated to be 10 percent of the increased costs that producers will incur in connection with increased or sustained production.

Secondary benefits from a national viewpoint were not considered in the economic justification of the project.

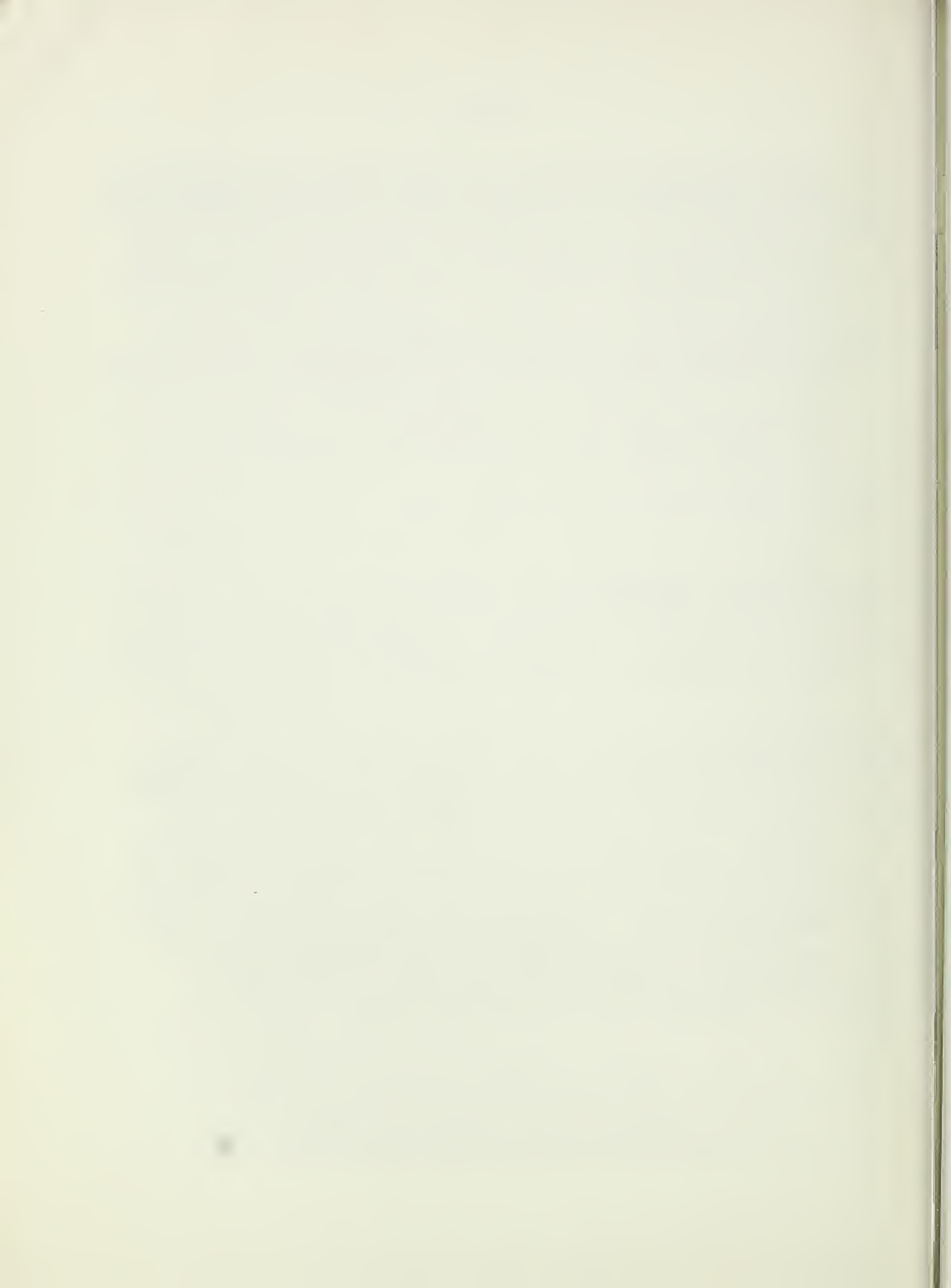
#### Archeological and Historical Investigations

The Department of Archives and History, along with the Institute of Archeology and Anthropology, were consulted for assistance in planning the project. The Institute of Archeology and Anthropology made a field reconnaissance and has prepared a report. No significant values were identified as being affected.

#### Fish and Wildlife

Representatives of the U.S. Fish and Wildlife Service and the South Carolina Wildlife and Marine Resources Department made a field study of the watershed to describe the existing wildlife resources. A report from the South Carolina Wildlife and Marine Resources Department, dated March 25, 1970, stated that the watershed contains very good fish and game habitat and recommended that no channel work be included in the plan. The agency had no objections to floodwater retarding structures. A report from the U.S. Fish and Wildlife Service, dated April 14, 1970, stated that some areas along Fairforest Creek appear to be wetland types 3 and 5, as described in that Service's Circular 39, "Wetlands of the United States". This report also recommended that channel excavation not be included in the plan.



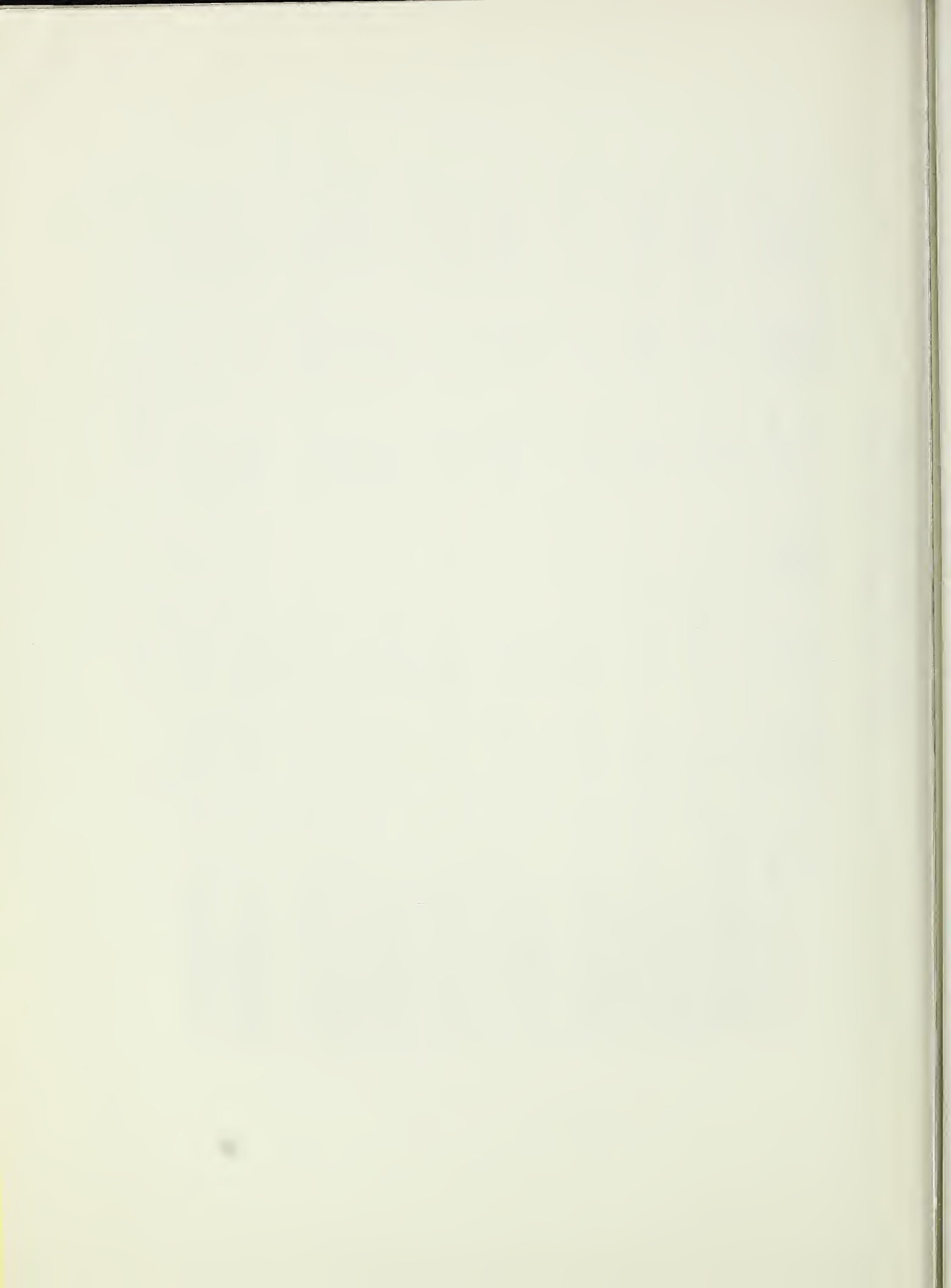


APPENDIX A - CHARACTERISTICS OF STREAMS

Fairforest Creek Watershed, South Carolina

Stream and Area Described	Bottom Width (ft.)	Bank Side Slope	Channel Depth (ft.)	Bank Vegetation	Channel Bottom Material	Adjacent Bank Land Use
Fairforest Creek, immediately above junction with Black Branch	27	1½:1	6	Trees, vines	Sand	Forest
Fairforest Creek, ¾ mile upstream of State Highway 12	20	1½:1	3	Trees, brush	Sand	Pasture
Fairforest Creek, ¾ mile upstream of State Highway 23	45	2:1	4.5	Trees, vines, brush	Sand	Forest
Rocky Creek, ¼ mile upstream of State Highway 19	10	Left, 3/4:1 Right, 2½:1	6	Trees, vines	Sand	Forest
Mitchel Creek, ¾ mile upstream of State Highway 19	17	3/4:1	8	Trees, brush	Sand	Pasture
Sugar Creek, ¼ mile upstream of State Highway 33	25	Left, 3/4:1 Right, 2:1	6	Trees, brush, vines	Sand, silt, gravel	Pasture
Tinker Creek, at State Highway 24	12	1:1	5	Brush, vines	Silt, sand	Pasture-forest
Brushy Creek, at State Highway 24	29	Left, 1:1 Right, ½:1	6	Trees, vines	Silt sand	Forest
Buffalo Creek, at State Highway 19	18	3/4:1	8	Brush, vines	Sand	Pasture

February 1975



APPENDIX B - QUALITY STANDARDS FOR CLASS "B" WATERS 1/

Class "B" waters are suitable for domestic supply after complete treatment in accordance with requirements of the South Carolina Department of Health and Environmental Control. They are also suitable for propagation of fish, industrial and agricultural uses and other uses requiring water of lesser quality.

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Items	Specifications
1. Fecal coliform	Not to exceed a geometric mean of 1000/100 ml based on five consecutive samples during any 30 day period; nor to exceed 2000/100 ml in more than 20 percent of the samples examined during such period (not applicable during or following periods of rainfall).
2. pH	Range between 6.0 and 8.5, except that swamp waters may range from pH 5.0 to pH 8.5.
3. Dissolved oxygen	Daily average not less than 5 mg/l, with a low of 4 mg/l, except that swamp waters may have an average of 4 mg/l.
4. Phenolic compounds	Not greater than 1 microgram per liter unless caused by natural conditions.

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1/ Water Classification Standards System for the State of South Carolina, South Carolina Pollution Control Authority, 1972.

February 1975





## Fairforest Creek Watershed, South Carolina

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical Oxygen Demand	
						5 Day	(MG/L)
BF-003 Bridge over Fairforest Creek on State Highway 88	64/ 5/21	19.5	6.8	5.7	240,000	6.0	6.0
	64/ 5/22	19.0	6.6	6.1	1,300,000	4.8	4.8
	65/ 5/17	18.5	6.6	6.3	210,000	8.1	8.1
	65/ 5/18	19.0	6.6	6.8	330,000	9.6	9.6
	65/ 5/20	19.0	6.6	5.5	470,000	12.4	12.4
	65/ 5/21	20.5	6.8	4.7	170,000	14.4	14.4
	65/ 8/31	19.0	6.9	7.7	240,000	13.0	13.0
	65/ 9/ 1	21.0	6.9	4.0	1,300,000	-	-
	65/ 9/ 2	21.0	6.9	3.4	610,000	13.4	13.4
	65/ 9/ 3	20.5	6.9	3.1	-	12.8	12.8
	65/11/29	8.0	6.4	8.6	-	8.4	8.4
	65/11/30	5.5	6.8	8.0	-	16.5	16.5
	65/12/ 1	4.0	7.0	9.6	-	11.9	11.9
	68/ 7/23	23.5	6.5	5.9	-	-	-
	68/ 7/24	22.0	6.6	4.6	-	6.8	6.8
	69/ 9/24	19.0	6.9	6.2	-	10.6	10.6
	69/ 9/25	19.0	6.8	5.8	-	5.9	5.9
	69/ 9/26	19.0	6.9	5.2	-	14.8	14.8
	70/10/27	16.0	6.0	8.6	-	-	-
	70/10/29	15.0	6.1	8.4	-	-	-
	70/10/30	16.0	6.4	7.8	-	-	-
	72/ 7/ 6	18.0	6.8	8.2	20	1.8	1.8
	73/ 6/25	22.0	6.8	9.4	6,000	2.9	2.9
	73/ 8/17	22.0	7.1	6.9	5,400	19.1	19.1
	73/10/17	15.0	7.1	9.8	-	-	-

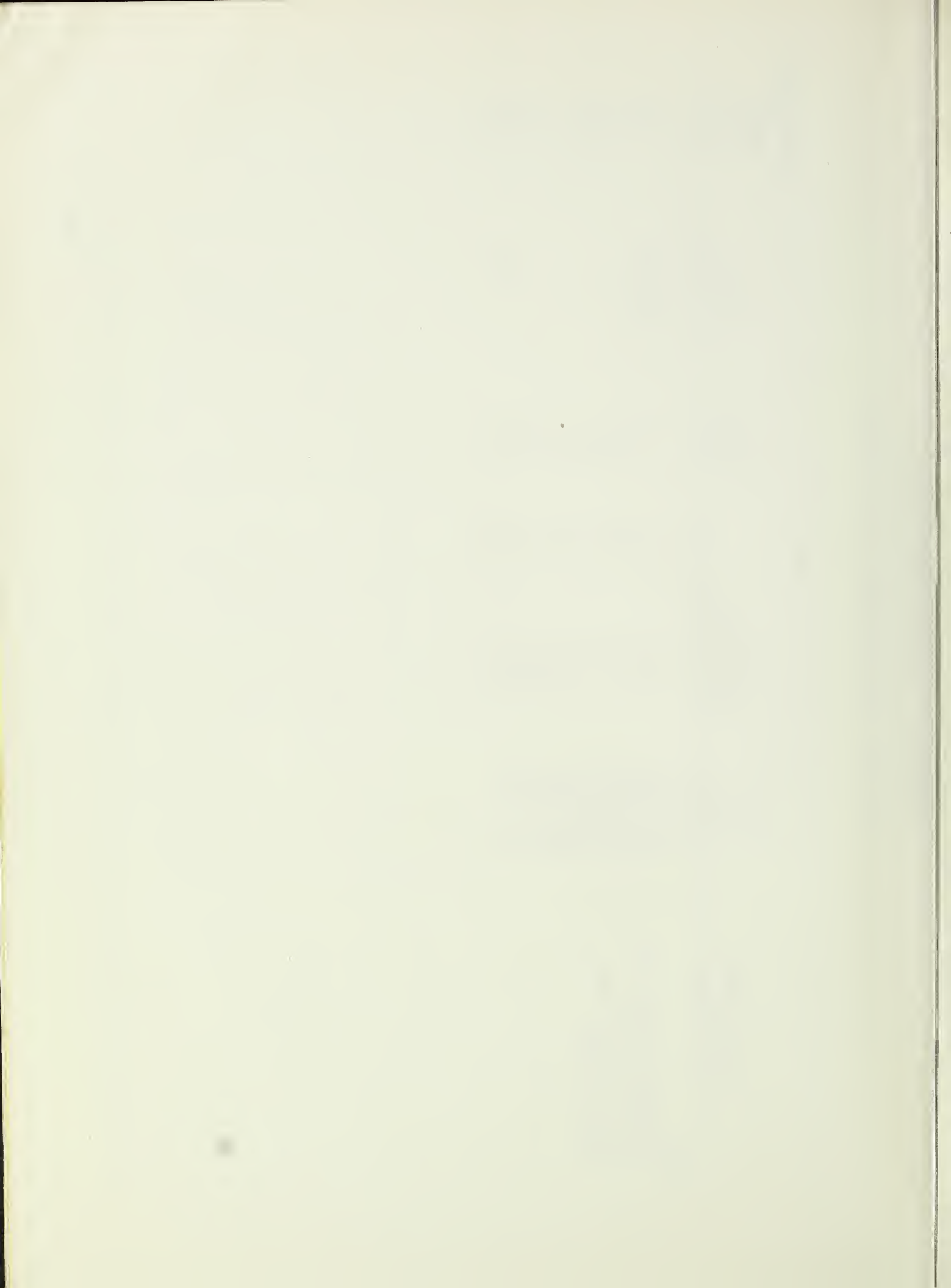


# APPENDIX C - SURFACE WATER QUALITY 1/

## Fairforest Creek Watershed, South Carolina

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
B-005	62/ 9/11	24.0	6.8	7.0	35,000		3.6
Abandoned bridge over	62/ 9/12	23.0	6.7	6.2	240,000		5.4
Fairforest Creek	65/11/29	6.5	6.8	10.2	-		5.9
below junction with	65/11/30	3.0	7.0	11.3	-		6.0
Pauline Creek	65/12/ 1	2.0	7.1	12.1	-		5.5
	68/ 7/23	23.0	6.9	8.1	-		-
	68/ 7/24	19.5	7.1	8.1	-		2.4
	71/ 6/14	19.0	6.6	8.2	330		0.8
	72/ 7/ 7	18.5	6.8	5.6	50		1.0

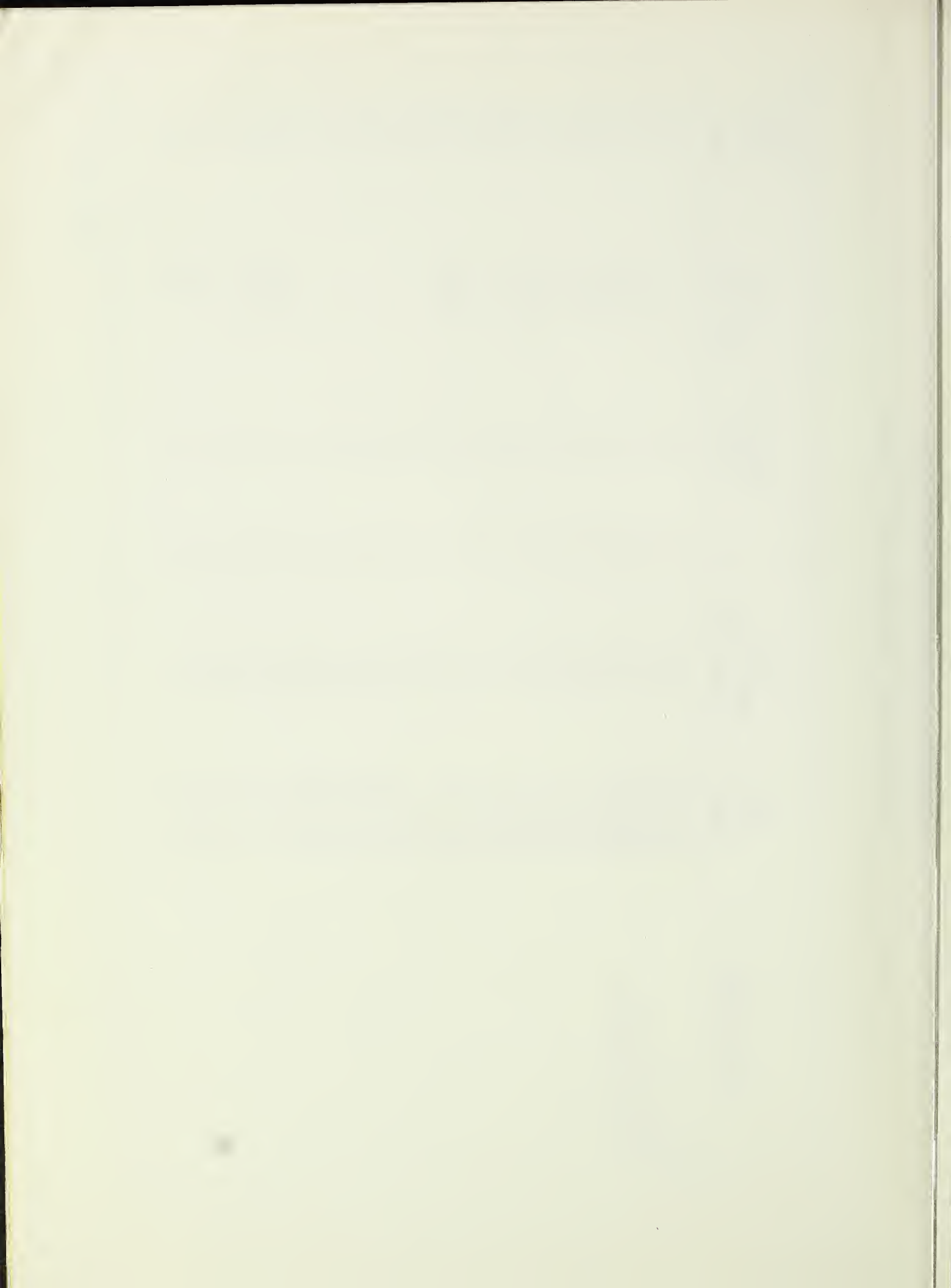




APPENDIX C - SURFACE WATER QUALITY 1/

Fairforest Creek Watershed, South Carolina

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
BF-007 Bridge over Fairforest Creek on State Highway 12	62/ 9/ 4	26.0	7.1	6.1	-		3.2
	62/ 9/ 5	27.0	7.3	5.8	-		1.5
	63/10/30	12.5	6.9	8.1	13,000		2.6
	63/10/31	9.0	6.9	8.5	13,000		3.6
	63/11/ 1	12.5	7.0	8.0	34,800		2.5
	64/10/ 2	18.5	7.0	6.0	97,000		4.0
	64/10/ 6	15.0	6.8	6.3	54,200		2.8
	64/10/ 7	13.0	7.0	7.2	160,000		2.3
	64/10/ 8	12.0	7.0	9.0	57,000		2.6
	64/10/ 9	-	7.2	8.3	-		4.5
	65/ 5/17	19.5	7.1	7.0	13,000		4.5
	65/ 5/18	19.5	7.1	6.7	33,000		3.8
	68/10/ 2	16.0	6.7	6.3	-		6.5
	68/10/ 3	18.0	6.8	5.3	-		5.5
	70/ 8/20	23.0	6.9	6.7	-		3.0
	70/ 8/21	23.0	6.9	6.7	-		2.9
	70/ 8/24	23.0	6.6	5.8	-		1.7
	71/ 9/16	19.0	6.3	7.1	-		1.2
	72/ 5/25	19.0	6.1	7.2	-		2.3
	72/ 8/ 1	22.0	6.3	6.1	4,960		4.6
	72/ 9/20	22.0	6.9	6.1	3,000		2.5
	73/ 5/ 7	16.0	6.9	8.2	30		3.5
	73/ 7/30	24.0	7.4	6.6	-		-
	73/ 9/11	22.0	6.9	7.4	130		2.2
	73/10/30	12.5	6.6	8.9	320		1.1

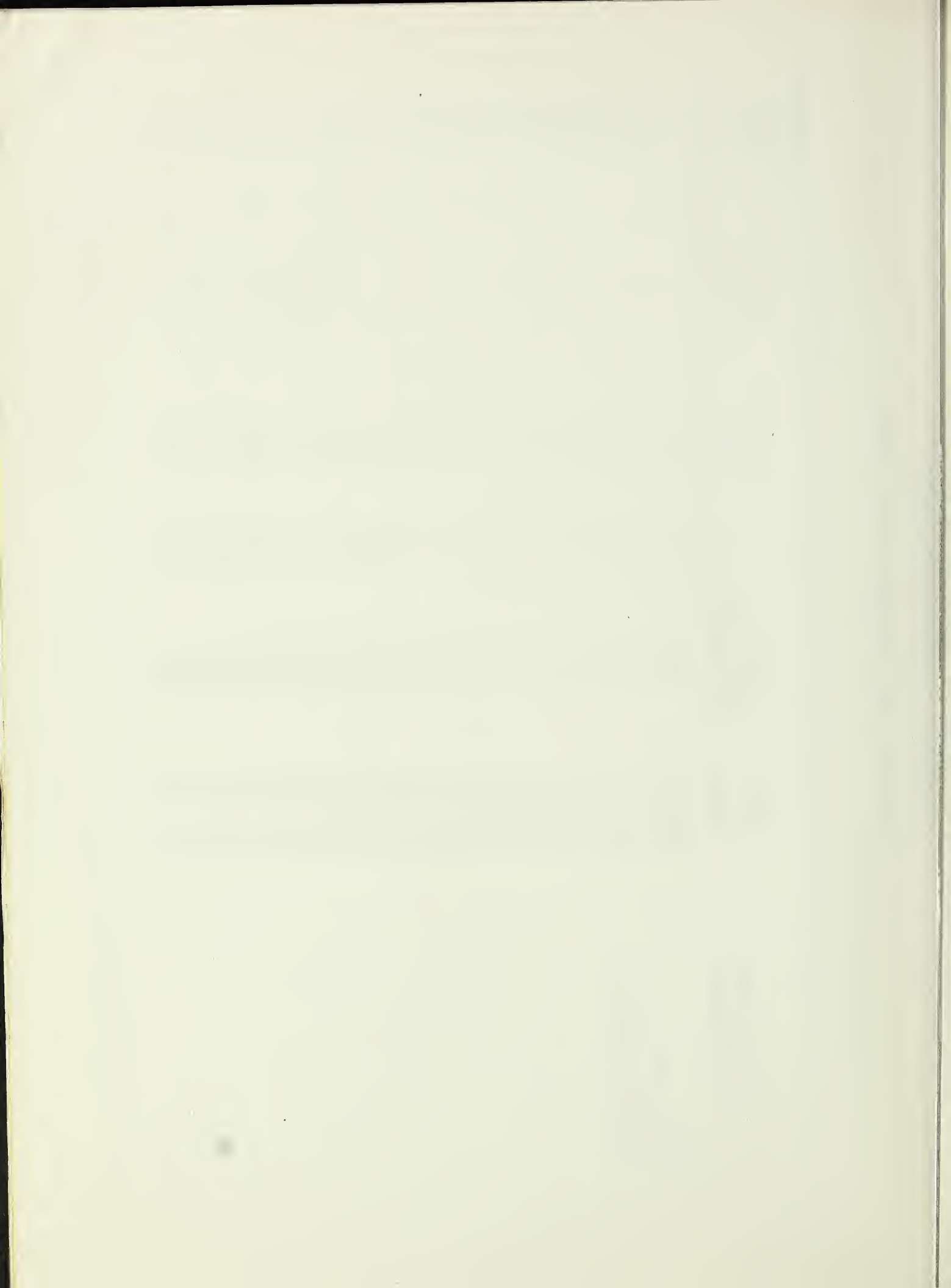


# APPENDIX C - SURFACE WATER QUALITY 1/

Fairforest Creek Watershed, South Carolina

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No /100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
B-066 Bridge over Fairforest Creek on State Highway 215	60/11/ 7	10.0	7.1	10.4	-	-	1.4
	60/11/10	10.0	7.3	9.9	-	-	1.5
	60/11/11	10.0	6.9	9.6	-	-	1.3
	60/11/14	10.0	7.3	10.3	-	-	1.3
	60/11/15	10.0	7.2	10.9	-	-	1.6
	60/11/16	11.0	7.1	9.9	-	-	1.3
	61/10/20	12.0	7.3	8.4	-	-	1.9
	61/10/23	12.0	7.1	9.0	-	-	1.0
	61/10/24	11.5	7.2	9.3	-	-	-
	61/10/25	12.5	7.3	8.9	-	-	1.1
	61/10/26	12.0	7.2	8.5	-	-	1.8
	62/ 8/ 6	25.5	6.9	6.8	-	-	1.8
	62/ 8/27	23.0	7.3	7.0	-	-	0.8
	63/ 4/29	15.5	7.0	8.3	-	-	2.2
	63/ 4/30	15.5	6.8	7.5	-	-	2.2
	63/ 5/ 1	15.0	6.5	7.4	-	-	2.5
	63/10/30	12.5	7.1	8.6	7,900	-	1.6
	65/ 4/26	18.5	7.3	7.3	54,200	-	3.1
	65/ 4/28	17.5	6.9	6.9	13,000	-	2.5
	65/ 4/29	14.5	7.0	8.1	-	-	1.9
	65/ 4/30	13.5	6.9	8.8	-	-	1.8
	68/ 9/26	19.0	6.9	7.6	-	-	2.4
	68/ 9/27	18.5	6.9	7.0	-	-	4.2
	70/ 7/14	24.0	7.2	7.0	-	-	1.6
	70/ 7/15	23.5	7.1	6.9	-	-	1.9
	70/ 7/20	23.5	7.3	7.0	-	-	1.6





## Fairforest Creek Watershed, South Carolina

Station Number and Location	Date of Sample	Water Temperature (centigrade)	pH	Dissolved Oxygen (MG/L)	Fecal Coliform (No./100ML)	Biochemical	
						Oxygen Demand	5 Day (MG/L)
B-066 (continued)	71/ 9/15	19.0	6.4	7.7	-	-	2.3
	71/ 9/16	19.0	6.1	-	-	-	0.4
	72/ 5/24	17.0	6.2	8.9	-	-	2.4
	72/ 7/31	23.0	6.4	6.4	2,020	-	3.4
	72/ 8/24	22.5	7.1	7.8	235	-	-
	72/10/ 2	-	7.2	-	285	-	-
	72/10/31	14.5	7.4	6.3	900	-	-
	72/11/21	11.5	6.8	6.9	560	-	-
	72/11/22	-	6.5	-	-	3.0	-
	73/ 1/16	-	-	11.0	-	-	-
	73/ 2/16	5.5	6.4	-	-	1.4	-
	73/ 3/16	19.5	6.5	7.9	-	0.6	-
	73/ 4/16	13.0	6.9	9.9	-	1.4	-
	73/ 5/29	21.0	6.7	6.7	-	4.4	-
	73/ 6/14	23.0	7.3	7.7	-	1.9	-
	73/10/31	12.0	6.7	9.2	-	1.3	-

1/ Computer Data, Surface Water Quality Samples, South Carolina Department of Health and Environmental Control, 1974.



APPENDIX D - WATER WELLS, MAXIMUM CONSUMPTION FROM WELLS AND THEIR CHEMICAL ANALYSES 1/

Fairforest Creek Watershed, South Carolina

Well Location and Number	Maximum Consumption MGD	Test Date	Solids 2/	Alkalinity	Calcium	Magnesium	Hardness	Iron	Chlorides	Acidity	Copper	Zinc
Pacolet Mills 442002	.200 (49 wells)	12-71 12-72 07-73	38 58 70	22 29 24	5.8 3.8 3.4	.8 1.3 1.1	18 14 13	. .2 .	4 4 2	8.3 6.6 6.6	. . .6	. . 1.9
Lockhart Power 444002	.121 (2 wells)	04-72 04-72 10-72 10-72 04-73	50 72 64 76 52	24 29 31 34 24	3.0 4.4 3.3 3.1 2.3	1.4 1.2 1.4 1.2 1.2	13 16 14 13 11	.1 .3 1.4 . 2.0	5 7 10 10 6	7.3 7.9 7.6 7.8 7.4	. . .1 . .1	. . .3 . .3
Meadowbrook, Inc. 542004	.036 (20 wells)	12-71 06-72 12-72 07-73	90 90 68 102	40 33 36 40	3.6 4.0 3.7 4.4	1.8 1.4 1.8 2.0	16 16 17 19	. . . .	1 4 3 3	6.9 7.6 7.3 7.1	.2 .1 .3 .1	. 1.9 2.0 .5
Stone Haven T.P. 642011	.140 (20 wells)	12-71 07-72 12-72 07-73	48 66 66 100	24 36 43 37	2.3 4.2 4.8 4.8	1.3 2.3 2.5 2.4	11 20 22 22	.1 . . .	1 3 2 2	6.9 7.4 7.6 7.4	. .2 .1 .2	.3 1.5 7.3 4.8
Airport Mobile Park 642016	.120	07-72 12-72 07-73	74 76 102	20 21 20	3.1 3.3 2.6	1.9 2.2 2.1	16 17 15	1.9 3.9 3.7	5 6 3	6.7 6.6 6.7	.1 . .	.1 . .

1/ South Carolina Department of Health and Environmental Control, 1974.

2/ All measured in parts per million.

February 1975





APPENDIX E - SOUTH CAROLINA DRINKING WATER STANDARDS 1/

The South Carolina Department of Health and Environmental Control collects samples of water from the distribution systems of public water supplies in South Carolina, and conducts chemical analyses in accordance with the Law, Rules and Regulations for Waterworks Systems in the State of South Carolina. These analyses are designed to determine if the finished water meets standards for chemical quality as set forth in the 1962 U.S. Public Health Service Drinking Water Standards. These analyses are also used to evaluate treatment processes where such processes are employed.

Characteristic or Chemical Substance	Limit
Total Solids	Should not exceed 500 mg/l
Turbidity	Should not exceed 5 t.u.
Color	Should not exceed 15 units
Alkalinity	Should not exceed 500 mg/l
Calcium	Related to hardness
Magnesium	Related to hardness
Hardness	Should not exceed 100 mg/l
Sodium	No standard. Provided as information for medical doctors when requested
Iron	Should not exceed 0.3 mg/l
Chloride	Should not exceed 250 mg/l
pH	Acceptable range from 6.5 to 8.5
Manganese	Should not exceed 0.05 mg/l
Copper	Should not exceed 1.0 mg/l
Zinc	Should not exceed 5.0 mg/l
Potassium	No standard. Provided as information for medical doctors when requested
Mercury	Should not exceed 0.5 ppb
Chromium	Should not exceed 0.05 mg/l
Cadmium	Should not exceed 0.01 mg/l
Lead	Should not exceed 0.05 mg/l

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1/ Law, Rules and Regulations for Waterworks Systems in the State of South Carolina, South Carolina State Board of Health, November 1970.

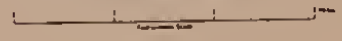




- LEGEND
- Interstate Highway
  - U.S. Highway
  - State Highway-Primary
  - State Highway-Secondary
  - Divided Highway
  - Paved Road
  - Unimproved Road
  - County Line
  - City Limits
  - National Forest and Park Boundaries
  - Railroad
  - Power Line
  - Pipeline
  - Drainage
  - Watershed Boundary
  - Critically Eroding Area



**CRITICALLY ERODING AREAS**  
**FAIRFOREST CREEK WATERSHED**  
 UNION AND SPARTANBURG COUNTIES  
 SOUTH CAROLINA  
 U. S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE  
 COLUMBIA SOUTH CAROLINA



Scale under feet does not include feet shown in 1963 showing area and perimeter. Not Survey Report.







LEGEND

- |  |                                     |  |                                       |
|--|-------------------------------------|--|---------------------------------------|
|  | Interstate Highway                  |  | Power Line                            |
|  | U. S. Highway                       |  | Pipeline                              |
|  | State Highway-Primary               |  | Drainage                              |
|  | State Highway-Secondary             |  | Watershed Boundary                    |
|  | Divided Highway                     |  | Flood Plain                           |
|  | Paved Road                          |  | National Forest Ownership             |
|  | Unimproved Road                     |  | Drainage Area Controlled By Structure |
|  | County Line                         |  | Area Benifited By Structure           |
|  | City Limits                         |  | Floodwater Retarding Structure        |
|  | National Forest and Park Boundaries |  | Site Number                           |
|  | Railroad                            |  |                                       |

PROJECT MAP  
FAIRFOREST CREEK WATERSHED  
SPARTANBURG AND UNION COUNTIES  
SOUTH CAROLINA

Approximate Scale  
Compiled at 1:31680 or 2" = 1 mile  
and reproduced at 1:63360 or 1" = 1 mile  
and 1:20,000 or 1" = 1/2 mile  
Data compiled from uncontrolled mosaic, 1965  
photographs and published Soil Survey Report  
8-73

4-R-33274

9-69 4-R-28440







